



COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DRAFT PERMIT April 30, 2019
TO WITHDRAW GROUNDWATER IN THE
EASTERN SHORE GROUNDWATER MANAGEMENT AREA

Permit Number: GW0072800
Effective Date: Mo Dy, 2019
Expiration Date: Mo Dy, 2034

Pursuant to Section 62.1-256 of the Ground Water Management Act of 1992 (Chapter 25, Title 62.1 of the Code of Virginia) and the Groundwater Withdrawal Regulations (Regulations) (9VAC25-610-10 *et seq.*), the State Water Control Board (Board) hereby authorizes the Permittee to withdraw and use groundwater in accordance with this permit.

Permittee Edward Thornton
Facility Ed, Pat, and Brandy Sue Farm
Facility Address 30327 Thornton Lane
Temperanceville, VA 23442

The Permittee's authorized groundwater withdrawal shall not exceed:

8,040,000 gallons per year,
1,900,000 gallons per month,

The permitted withdrawal will be used to provide an agricultural water supply. Other uses are not authorized by this permit.

The Permittee shall comply with all conditions and requirements of the permit.

By direction of the State Water Control Board, this Permit is granted by:

Signed _____ Date _____

Director, Office of Water Supply

This permit is based on the Permittee's application submitted on November 30, 2017, and subsequently amended to include supplemental information provided by the Permittee. The following are conditions that govern the system set-up and operation, monitoring, reporting, and recordkeeping pertinent to the Regulations.

Part I Operating Conditions

A. Authorized Withdrawal

1. The withdrawal of groundwater shall be limited to the following wells identified in the table below. Withdrawals from wells not included in Table 1 are not authorized by this permit and are therefore prohibited. 9VAC25-610-140.A

Table 1

Owner Well Name	DEQ Well #	Well Depth (ft.)	Screen Intervals	Aquifer*	Latitude	Longitude	Datum
Well 1	100-01328	255	235-255	Middle Yorktown-Eastover	37° 53' 20.70"	-75° 32' 38.32"	NAD27
Well 2	100-01329	To Be Determined**	To Be Determined**	Middle Yorktown-Eastover	37° 53' 20.60"	-75° 32' 39.72"	NAD27
Well 3	100-01330	220	210-220	Middle Yorktown-Eastover	37° 53' 20.76"	-75° 32' 33.36"	NAD27
Well 4	100-01331	260	240-260	Middle Yorktown-Eastover	37° 53' 20.40"	-75° 32' 30.84"	NAD27
Well 5	100-01332	260	240-260	Middle Yorktown-Eastover	37° 53' 24.0"	-75° 32' 30.84"	NAD27
Well 6	100-01333	240	225-240	Middle Yorktown-Eastover	37° 53' 22.20"	-75° 32' 29.76"	NAD27

*Aquifer in use was estimated based on the USGS Eastern Shore Hydrogeologic Framework and will be updated using site-specific geophysical data collected, as required by the permit.

**No Well construction information was located. Well construction information for modeling was based on Well #1 and will be updated using camera survey data collected, as required by the permit.

2. Any actions that result in a change to the well operation, construction, or pump intake setting of wells included in this permit must be pre-approved by the Department of Environmental Quality (Department) in writing prior to implementing the change and a revised GW-2 Form must be submitted to the Department within 30 days after the physical construction of a well is altered or the pump intake setting has been changed. If changes are a result of an emergency, notify the Department within 5 days from the change. 9VAC25-610-140.C

B. Pump Intake Settings

1. The Permittee shall not place a pump or water intake device lower than the top of the uppermost confined aquifer that a well utilizes as a groundwater source or lower than the bottom of an unconfined aquifer that a well utilizes as a groundwater source in order to prevent dewatering of the aquifer, loss of inelastic storage, or damage to the aquifer from compaction. 9VAC25-610-140.A.6
2. Pump settings in individual wells are limited as follows. Any change in the pump setting must receive prior approval by the Department.

Owner Well Name	DEQ Well #	Max Pump Setting (feet below land surface)*
Well 1	100-01328	219
Well 2	100-01329	219
Well 3	100-01330	219
Well 4	100-01331	219
Well 5	100-01332	219
Well 6	100-01333	219
Well 7	100-01328	219

*Max pump settings were estimated based on the USGS Eastern Shore Hydrogeologic Framework. Following the collection of the geophysical log and camera survey data required by this permit, updated site-specific maximum pump setting depths will be provided by the Department to replace these estimated limits.

C. Reporting

1. Water withdrawn from each well shall be recorded consistently at the end of each month and reported to the Office of Water Supply, in paper or electronic format, on a form provided by the Department by the tenth (10th) day of each January, April, July and October for the respective previous calendar quarter. Records of water use shall be maintained by the Permittee in accordance with Part III.F, 1 through 5 of this permit. 9VAC25-610-140.A.9
2. The Permittee shall report any amount in excess of the permitted withdrawal limit by the fifth (5th) day of the month following the month when such a withdrawal occurred. Failure to report may result in compliance or enforcement activities. 9VAC25-610-140.C
3. The following is a summary of reporting requirements for specific facility wells:

Owner Well Name	DEQ Well #	Reporting Requirements
Well 1	100-01328	Water Use
Well 2	100-01329	Water Use
Well 3	100-01330	Water Use
Well 4	100-01331	Water Use
Well 5	100-01332	Water Use
Well 6	100-01333	Water Use
Well 7	100-01328	Water Use

D. Water Conservation and Management Plan

1. The Water Conservation and Management Plan (WCMP) submitted in the application received December 1, 2017 and subsequently amended and then approved by the Department is incorporated

by reference into this permit and shall have the same effect as any condition contained in this permit and may be enforced as such.

2. By the end of the first year of the permit cycle (Mo Dy, 2020) the Permittee shall submit a detailed description of their leak detection and repair program activities and documentation to the Department that these activities have been conducted. This documentation shall include frequency of the activities completed and the findings and results of the activities during the first year of the permit term. 9VAC25-610-100.B.1.b,2.b,or 3.b
3. As soon as completed but not later than the end of the second year of the permit cycle (Mo Dy, 2021) the Permittee shall submit to the Department results of a 12 month audit of the total amount of groundwater used in the distribution system and the separate amounts used for drinking and cooling. This audit report shall include the flock cycle start and end dates during the year, and any necessary changes to the leak detection and repair program or operations that affected water use. 9VAC25-610-100.B.1.b,2.b,or 3.b
4. A report on the plan's effectiveness in maintaining or reducing water use and a summary of proposed revisions to the WCMP to address any elements that can be improved based on operations to date shall be submitted by the end of years five (Mo Dy, 2024) and ten (Mo Dy, 2029) of the permit term. These reports shall include as appropriate: 9VAC25-610-140.C
 - a. Any new water saving equipment installed or water saving processes adopted;
 - b. A summary of the operation of the cooling system for the houses during the report period including what months the cooling system was operated;
 - c. Evaluation of the leak detection and repair program with a summary of any significant leaks found and repaired; and
 - d. A summary of the flock cycles and overall water use patterns for each year covered by the report.
5. If revisions or additions to the plan are necessary an updated WCMP shall be submitted to the Department for approval along with the report prior to implementation of the revised plan
6. Records of activities conducted pursuant to the WCMP are to be submitted to DEQ upon request.

E. Mitigation Plan

The Mitigation Plan approved on March 22, 2018 by the Department is incorporated by reference into this permit and shall have the same effect as any condition contained in this permit and may be enforced as such. 9VAC25-610-110.D.3.g

F. Well Tags

1. Each well that is included in this permit shall have affixed to the well casing, in a prominent place, a permanent well identification plate that records, at a minimum, the DEQ well identification number, the groundwater withdrawal permit number, the total depth of the well, and the screened intervals in the well. Such well identification plates shall be in a format specified by the Board and are available from the Department. 9VAC25-610-140.A.12

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2. Well tags shall be affixed to the appropriate well casing within 30 days of receiving the tags from the Department. The accompanying well tag installation certification form shall be returned to the Department within 60 days of receipt of the tags. 9VAC25-610-140.C

Part II

Special Conditions

Pursuant to 9VAC25-610-140.B and C, the following Special Conditions apply to this permit in order to protect the public welfare, safety, and health or conserve, protect and help ensure the beneficial use of groundwater.

A. Geophysical Log Data Collection

June 30, 2024 a complete suite of geophysical logs (Spontaneous Potential, Single Point Resistance, 16/64 Short and Long Normal, Natural Gamma at a scale of 20 ft. per inch) shall be obtained from at least 2 boreholes at the locations and depths approved by the Department during the coordination process. Given the unknown hydrogeology at the site and the known potential for significant horizontal variability, additional geophysical logs may be required as determined by the Department during the drilling work to assess the well field area. An electronic and hard copy of the geophysical logs shall be submitted to the Department within 30 days of collection to allow determination of the top and bottom of the aquifer in use. 9VAC25-610-140.C

At least two months prior to the scheduled geophysical logging, the Permittee shall notify the Department of the drilling timetable to receive any further guidance needed on performing the geophysical logging and to allow scheduling of Department staff to make a site visit during the drilling of the borehole and/or the geophysical logging. Geophysical log data collected without the oversight of the Department will not be accepted.

B. Pump Intake Determination and Reset

Within 90 days of notification of the maximum pump setting depth as determined by Department staff based on new geophysical log data obtained by the Permittee as required by the permit, the Permittee shall submit documentation from a certified well provider, or other source as accepted by the Department, that the pump intake for each production well is set above the setting stated in the notification.

C. Meter Installation Verification/Correction

If notified by DEQ through an inspection report that meters meeting the requirements set forth in Part III Condition I of this permit have not been correctly installed on each production well in such a manner as to record total withdrawals from the well including both cooling water and drinking water, the Permittee shall correct any identified meter issues within 60 days of notification.

D. Unknown Well Construction

By October 31, 2022 the Permittee shall perform a camera survey of Well #2, DEQ Well #100-01329, to determine the well depth, casing size, and type, and screen interval(s). This evaluation is also to include documentation of the pump intake depth and capacity. A video of the survey and a completed GW-2

form base on the camera survey results is to be submitted to the Department within 30 days of completion.

At least 30 days prior to the scheduled camera survey, the Permittee shall notify the Department of the survey schedule to receive any further guidance needed and to allow scheduling of Department staff to make a site visit during the camera survey. A camera survey with inconclusive/unclear data will not be accepted by the Department. Undocumented wells will be required to be abandoned in the next permit term.

E. Alternative Source Investigation

1. By September 30, 2025 the Permittee shall conduct an investigation of the surficial aquifer (Columbia) to evaluate the ability of the surficial aquifer to provide all or part of the water supply needs for the facility. The investigation shall include water quality and pump test data collected from a surficial aquifer test well constructed on-site with Department oversight to ensure the well is properly screened in the surficial aquifer. A geophysical log shall be obtained from the surficial aquifer test well per Part III.K of the permit unless a geophysical log collected from an existing production well is accepted by DEQ as representing the Columbia aquifer at the test well location. An existing well screened in the surficial aquifer located on or near the facility property may be used where approved by DEQ as an alternative. An existing well must have sufficient well construction information available to verify it is screened in the surficial aquifer and properly constructed in order to be considered.
2. A report on the results of the investigation shall be provided to DEQ within 6 years of permit issuance (March 31, 2026).

Part III General Conditions

A. Duty to Comply

The Permittee shall comply with all conditions of the permit. Nothing in this permit shall be construed to relieve the permit holder of the duty to comply with all applicable federal and state statutes, regulations and prohibitions. Any permit violation is a violation of the law and is grounds for enforcement action, permit termination, revocation, modification, or denial of a permit application. 9VAC25-610-130.A

B. Duty to Cease or Confine Activity

It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the activity for which a permit has been granted in order to maintain compliance with the conditions of the permit. 9VAC25-610-130.B

C. Duty to Mitigate

The Permittee shall take all reasonable steps to avoid all adverse impacts that may result from this withdrawal as defined in 9VAC25-610-10 and provide mitigation of the adverse impact when necessary

as described in 9VAC25-610-110.D.3.g. 9VAC25-610-130.C

D. Inspection, Entry, and Information Requests

Upon presentation of credentials, the Permittee shall allow the Board, the Department, or any duly authorized agent of the Board, at reasonable times and under reasonable circumstances, to enter upon the Permittee's property, public or private, and have access to, inspect and copy any records that must be kept as part of the permit conditions, and to inspect any facilities, well(s), water supply system, operations, or practices (including sampling, monitoring and withdrawal) regulated or required under the permit. For the purpose of this section, the time for inspection shall be deemed reasonable during regular business hours. Nothing contained herein shall make an inspection time unreasonable during an emergency. 9VAC25-610-130.D

E. Duty to Provide Information

The Permittee shall furnish to the Board or Department, within a reasonable time, any information that the Board may request to determine whether cause exists for modifying or revoking, reissuing, or terminating the permit, or to determine compliance with the permit. The Permittee shall also furnish to the Board or Department, upon request, copies of records required to be kept by regulation or this permit. 9VAC25-610-130.E

F. Monitoring and Records Requirements

1. The Permittee shall maintain a copy of the permit on-site and/or shall make the permit available upon request. 9VAC25-610-130.E
2. Monitoring of parameters shall be conducted according to approved analytical methods as specified in the permit. 9VAC25-610-130.F.1
3. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. 9VAC25-610-130.F.2
4. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart or electronic recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit, for a period of at least three years from the date of the expiration of a granted permit. This period may be extended by request of the Board at any time. 9VAC25-610-130.F.3
5. Records of monitoring information shall include as appropriate: 9VAC25-610-130.F.4
 - a. the date, exact place and time of sampling or measurements;
 - b. the name(s) of the individual(s) who performed the sampling or measurements;
 - c. the date the analyses were performed;
 - d. the name(s) of the individual(s) who performed the analyses;

- e. the analytical techniques or methods supporting the information, such as observations,
- f. readings, calculations and bench data used;
- g. the results of such analyses; and
- h. chain of custody documentation.

G. Environmental Laboratory Certification

The Permittee shall comply with the requirement for certification of laboratories conducting any tests, analyses, measurements, or monitoring required pursuant to the State Water Control Law (§ [62.1-44.2](#) et seq.), Environmental Laboratory Certification Program (§ 2.2-1105 et seq.), Certification for Noncommercial Environmental Laboratories (1VAC30-45), and/or Accreditation for Commercial Environmental Laboratories (1VAC30-46), and

- a. Ensure that all samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
- b. Conduct monitoring according to procedures approved under 40CFR Part 136 or alternative methods approved by the U.S. Environmental Protection Agency.
- c. Periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will ensure accuracy of measurements. (1VAC30-45-20)

H. Future Permitting Actions

1. A permit may be modified or revoked as set forth in Part VI of the Regulations. 9VAC25-610-290 and 9VAC25-610-130.G
2. If a Permittee files a request for permit modification or revocation, or files a notification of planned changes, or anticipated noncompliance, the permit terms and conditions shall remain effective until the Board makes a final case decision. This provision shall not be used to extend the expiration date of the effective permit. 9VAC25-610-130.G
3. Permits may be modified or revoked upon the request of the Permittee, or upon Board initiative, to reflect the requirements of any changes in the statutes or regulations. 9VAC25-610-130.G
4. The Permittee shall schedule a meeting with the Department prior to submitting a new, expanded or modified permit application. 9VAC25-610-85
5. A new permit application shall be submitted 270 days prior to the expiration date of this permit, unless permission for a later date has been granted by the Board, to continue a withdrawal greater than or equal to 300,000 gallons in any month while an application for a renewal is being processed. 9VAC25-610-96
6. A new permit application shall be submitted 270 days prior to any proposed modification to this

permit that will (i) result in an increase of withdrawal above permitted limits; or (ii) violate the terms and conditions of this permit. 9VAC25610-96

7. The applicant shall provide all information described in 9VAC25-610-94 for any reapplication. 9VAC25-610-96.C
8. The Permittee must notify the Department in writing of any changes to owner and facility contact information within 30 days of the change. 9VAC25-610-140.C

I. Metering and Equipment Requirements

1. Each well and/or impoundment or impoundment system shall have an in-line totalizing flow meter to read gallons, cubic feet, or cubic meters installed prior to beginning the permitted use. Meters shall produce volume determinations within plus or minus 10% of actual flows. 9VAC25-610-140.A.7.b
 - a. A defective meter or other device must be repaired or replaced within 30 days.
 - b. A defective meter is not grounds for not reporting withdrawals. During any period when a meter is defective, generally accepted engineering methods shall be used to estimate withdrawals. The period during which the meter was defective must be clearly identified in the groundwater withdrawal report required by Part I, Subsection D of this permit. An alternative method for determining flow may be approved by the Board on a case-by-case basis.
2. Each well shall be equipped in a manner such that water levels can be measured during pumping and non-pumping periods without dismantling any equipment. Any opening for tape measurement of water levels shall have an inside diameter of at least 0.5 inches and be sealed by a removable plug or cap. The Permittee shall provide a tap for taking raw water samples from each permitted well. 9VAC25-610-140.A.7.e

J. Minor Modifications

1. A minor modification to this permit must be made to replace an existing well(s) or add an additional well(s) provided that the well(s) is screened in the same aquifer(s) as the existing well(s), and is in the near vicinity of the existing well(s), the total groundwater withdrawal does not increase, the area of impact does not increase, and the well has been approved by the Department prior to construction. 9VAC25-610-330.B.4 and 5
2. A minor modification to this permit must be made to combine withdrawals governed by multiple permits when the systems are physically connected as long as interconnection will not result in additional groundwater withdrawal and the area of impact will not increase. 9VAC25-610-330.B.6
3. Minor modifications to this permit must also be made to:
 - a. Change an interim compliance date up to 120 days from the original compliance date, as long as the change does not interfere with the final compliance date. 9VAC25-610-330.B.7
 - b. Allow for change in ownership when the Board determines no other change in the permit is

necessary and the appropriate written agreements are provided in accordance with the transferability of permits and special exceptions. 9VAC25-610-320 and 9VAC25-610-330.B.8

- c. Revise a Water Conservation and Management Plan to update conservation measures being implemented by the Permittee that increase the amount of groundwater conserved. 9VAC25-610-330.B.9

K. Well Construction

At least 30 days prior to the scheduled construction of any well(s), the Permittee shall notify the Department of the construction timetable and receive prior approval of the well(s) location(s) and acquire the DEQ Well number. All wells shall be constructed in accordance with the following requirements.

1. A well site approval letter or well construction permit must be obtained from the Virginia Department of Health prior to construction of the well. 9VAC25-610-130.A
2. A complete suite of geophysical logs (Spontaneous Potential, Single Point Resistance, 16/64 Short and Long Normal, Natural Gamma) shall be completed for the well and submitted to the Department along with the corresponding completion report. 9VAC25-610-140.C
3. The Permittee shall evaluate the geophysical log and driller's log information to estimate the top of the target aquifer and; therefore, a depth below which the pump shall not be set. The Permittee's determination of the top of the target aquifer shall be submitted to the Department for review and approval, or approved on site by the Department's Groundwater Characterization staff, prior to installation of any pump. 9VAC25-610-140.A.6
4. The Permittee shall install gravel packs and grout in a manner that prevents leakage between aquifers. Gravel pack shall be terminated close to the top of the well screen(s) and shall not extend above the top of the target aquifer. 9VAC25-610-140.C
5. A completed GW-2 Form and any additional water well construction documents shall be submitted to the Department within 30 days of the completion of any well and prior to the initiation of any withdrawal from the well. 9VAC25-610-140.C. The assigned DEQ Well number shall be included on all well documents. 9VAC25-610-140.C
6. In addition to the above requirements, construction of a Water Level Monitoring State Observation Well (SOW) requires:
 - a. The Permittee shall coordinate activities with the Department's Groundwater Characterization Program (GWCP) to determine the appropriate observation well location and construction schedule, along with the needed screen interval(s), and other completion details following review of geophysical logging. 9VAC25-610-140.C
 - b. Prior to preparation of bid documents for construction of the observation well, the Permittee shall notify the Department and shall include any GWCP requirements in the bid documents. At a minimum, the Department will require a pre-bid meeting with interested drilling

contractors and a pre-construction meeting with the successful bidder. 9VAC25-610-140.C

- c. Instrumentation to meet the requirements for real-time data transmission consistent with the State Observation Well Network shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall not be required to install the equipment. 9VAC25-610-140.C

7. In addition to the above requirements, construction of a Chloride Monitoring SOW requires:

- a. The Permittee shall coordinate activities with the Department's Groundwater Characterization Program (GWCP) to determine the appropriate observation well location and construction schedule, along with the needed screen interval(s), and other completion details following review of geophysical logging. 9VAC25-610-140.C
- b. Prior to preparation of bid documents for construction of the observation well, the Permittee shall notify the Department and shall include any GWCP requirements in the bid documents. At a minimum, the Department will require a pre-bid meeting with interested drilling contractors and a pre-construction meeting with the successful bidder. 9VAC25-610-140.C
- c. Instrumentation to meet the requirements for real-time data transmission consistent with the State Observation Well Network shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall not be required to install the equipment. 9VAC25-610-140.C
- d. Instrumentation to meet the requirements for continuous measurement of specific conductance from multiple levels within the well screen shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall not be required to install the equipment. 9VAC25-610-140.C

L. Permit Reopening

This permit may be reopened for the purpose of modifying the conditions of the permit as follows:

- a. To meet new regulatory standards duly adopted by the Board. 9VAC25-610-140.A.11
- b. When new information becomes available about the permitted withdrawal, or the impact of the withdrawal, which had not been available at permit issuance and would have justified the application of different conditions at the time of issuance. 9VAC25-610-310.B.1
- c. When the reported withdrawal is less than 60% of the permitted withdrawal amount for a five year period. 9VAC25-610-310.B.2
- d. If monitoring information indicates the potential for adverse impacts to groundwater quality or level due to this withdrawal. 9VAC25-610-140.C

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

DRAFT PERMIT ISSUANCE FACT SHEET April 30, 2019

Groundwater Withdrawal Permit Number: GW0072800

Application Date: November 30, 2017

The Department of Environmental Quality (Department or DEQ) has reviewed the application for a Groundwater Withdrawal Permit. Based on the information provided in the application and subsequent revisions, DEQ has determined that there is a reasonable assurance that the activity authorized by the permit is a beneficial use as defined by the regulations. Groundwater impacts have been minimized to the maximum extent practicable. The following details the application review process and summarizes relevant information for developing the Permit and applicable conditions.

Permittee / Legal Responsible Party

Name & Address: Edward Thornton
30327 Thornton Lane
Temperanceville, VA 23442
Phone: (757) 824-3037

Facility Name and Address

Name & Address: Ed, Pat, and Brandy Sue Farm
30327 Thornton Lane
Temperanceville, VA 23442
Phone: (757) 824-3037

Contact Information:

Name: Edward Thornton
E-mail: dargy33@yahoo.com
Phone: (757) 824-3037

Proposed Beneficial Use:

The proposed use for this withdrawal is for agriculture. Withdrawals will supply a poultry growing operation with water for cooling of chicken houses as well as for direct consumption by poultry.

Processing Dates

Processing Action	Date Occurred/Received
Pre-Application Meeting:	September 7, 2017
Application Received:	December 1, 2017
Permit Fee Deposited by Accounting:	Not Applicable
Notice of Deficiency Sent	February 22, 2018
Response to Notice of Deficiency Received:	March 14, 2018
Request for Additional Information Sent:	April 16, 2018
Response to Request for Additional Information Received:	April 23, 2018
Local Government Ordinance Form Received:	April 9, 2018
Application Complete:	June 20, 2018
Submit Request for Technical Evaluation:	December 18, 2018
Technical Evaluation Received:	February 12, 2019
Draft Permit Package Sent:	April 30, 2019
Submit Draft Permit for Public Notice:	MO DY, 2019
Public Notice Published:	MO DY, 2019
End of 30-Day Public Comment Period:	MO DY, 2019
Response to Public comment:	MO DY, 2019
Public Meeting or Hearing:	MO DY, 2019

Application

Application Information

Ed, Pat, and Brandy Sue Farm (Thornton Farm) is a poultry farm owned by Edward Thornton and located in Accomack County. Morey Farm has 8 poultry houses and 6 production wells. The houses are sized as follows: 5 houses at 40 ft. width and 4 houses at 50 ft. widths. The farm produces broilers. Additional information on how water is used at the farm is discussed in the basis of need section of the fact sheet.

The property and house cover two separate and adjacent tax parcels (41-2-A and 41-A-161A), with the wells for the chicken houses being constructed between 1995 and 2016. The wells provide water for the poultry operations, a cattle operation (approximately 38 head of cattle), and the residential use of the onsite farmhouse (2 occupants).

Location of Facility/Withdrawal:

Water Supply Planning Unit: Accomack & Northampton

County: Accomack County

GWMA/Aquifer: Eastern Shore/ Middle Yorktown-Eastover

Conjunctive Use Source: This system uses no surface water and is therefore not a conjunctive use

system.

Withdrawal Use, Current Need, and Projected Demand:

Basis of Need: Poultry farms use groundwater to provide drinking water to the birds as well as to supply water to either misting systems or evaporative cooling pads designed to regulate temperatures in the house and keep the birds cool. Cooling is primarily required in summer.

Water use for poultry farms varies seasonally as well as in response to the poultry life cycle. Generally during winter, fall, and spring, facility withdrawals rise and fall in a predictable pattern every 50-60 days, or the length of time it takes to raise a flock, with increased usage primarily resulting from increased water consumption as the birds gain weight. This water use pattern starts with low water consumption volumes for chick development and peaks in the last 20-30 days as growers seek to maximize adult weight gains. Typically, farms raise around five flocks per year with this cycle repeating each time. During the summer, withdrawal volumes increase due to additional water usage for flock cooling purposes.

Water volumes used for consumption are controlled by a computer system that provides water to the drinker system, which provides access to water for the birds but limits spillage or excess moisture from entering the house. Avoiding excess moisture is critical to bird health and as a result careful conservation of water is already a key tenet of management in a broiler house. The computer tracks water supplied to the drinking system and records the volume. This data was maintained by some farms but in many cases was not recorded long-term. Where available, data from the computer is discussed in the historic withdrawals section of the factsheet.

The cooling systems are operated based on temperature and humidity and while usage is typically restricted to summers, operation of the cooling systems tends to vary between farms. Historically, water supplied to the cooling systems was not metered so very limited data is available on usage.

Water Demand Projection: Water demands are based on estimated drinking and cooling water amounts needed to supply all the system houses. Proposed withdrawal limits were calculated based on the total of both consumption (drinking water) and cooling. Water use for consumption at the Thornton Farm was calculated through a multi-step analysis by the applicant, using tracked water usage for an actual 50 day flock and review of limited meter data from August to October of 2017; however, it should be noted that data from August and September were not considered due to a backflow issue that produced inaccurate meter readings. Otherwise, the applicant compared tracked usage, flocks/year, house area, and an estimated mortality rate to arrive at estimated monthly and annual needs for both consumption and cooling purposes.

As no metered data on volumes used for cooling was available from farms operating on the shore, a procedure for estimating water use for cooling was developed for use based on discussions with industry stakeholders, individual farmers, and a review of available literature. House size and cooling fan capacity were identified as the major variables determining water use for cooling poultry houses. A formula based on 1.6 gallons per year per cubic foot per minute (cfm) of cooling fan capacity was determined to be representative for the Delmarva area poultry industry. The major variable for cooling fan capacity is the width of the house as that provides for the number and size of cooling fans

that can be installed. The combined total width of the houses for the facility was used as the basis to estimate cooling water use.

Staff used the applicant's data to calculate both consumption and cooling, based on the standard formulas, noted above, and found the results to be comparable to those calculated by the applicant. The applicant's water use calculations are attached to the fact sheet at Attachment 4. The permit requires metering of the wells to record total water use and actual amounts used for cooling will be collected.

A small amount of water is used for general farm operation including washing equipment, cleaning houses between flocks, a cattle operation (approximately 38 head of cattle), and the residential use of the onsite farmhouse. Residential usage of 3,100 gallons/month (g/mo.) and 36,500 gallons/year (g/yr.) was estimated and included in the final requested amounts. The cattle operation was estimated, based on Virginia Tech Cooperative Extension data for average water consumption, with a total estimated usage of 23,560 g/mo. and 194,154 g/yr.

Water demands are not expected to change as the amount requested represents the maximum capacity of the farm and no additional houses are considered in this permit. Therefore, no projections are included for this facility.

Withdrawal Volumes Requested: The applicant originally requested 8,175,433 annually and 831,503 monthly; however, after recalculating needs based upon the cooling calculation procedure noted above, the following withdrawal volumes were requested based upon the projected groundwater demand.

Period of Withdrawal	Actual Volume (gal.)	Volume in MGD
Maximum Monthly:	1,834,850	.059
Maximum Annual:	8,036,234	.022

DEQ Evaluation

Historic Withdrawals: The applicant provided tracked water usage, by house, for an actual 50-day flock during the August-October of 2017. The total water usage for all 8 houses was 564,237 gallons. Average usage across all houses showed 9% of the total water used during the first 15 days of chicken development, 28% during the middle 15 days of chicken development, and the remaining 63% of water usage used during the last 20 days of finishing. Total usage across houses ranged from 57,145 gallons to 81,713 gallons during the full flock life cycle.

Analysis of Alternative Water Supplies: The Eastern Shore of Virginia is an area primarily served by groundwater with the majority of withdrawals coming from the three confined Yorktown-Eastover (Upper/Middle/Lower) aquifers. There is limited surface water availability with the majority of streams being too small to supply sufficient water for most purposes, larger water bodies are typically tidally influenced, and water quality concerns have limited the development of these sources. Withdrawals from the surficial aquifer, or water table, are one viable alternative to withdrawals from the confined system. While withdrawals from the surficial aquifer can present additional water quality challenges in the form of iron forming bacteria and increased vulnerability to surface contaminants, it may be viable in some locations where capacity and quality are sufficient. In general, drinking water for poultry must

be of higher quality than the cooling water. In most cases, site-specific data will be necessary to determine the viability of the surficial aquifer and to determine what portions of the use it can supply.

Public Water Supply: The proposed withdrawal does not contain a public water supply component.

Water Supply Plan Review: A Water Supply Planner coordination request was sent on September 10, 2018 and a response was received on January 9, 2019. The response noted several key items.

The Accomack County Regional Water Supply Plan (Plan) includes irrigating agricultural facilities using both groundwater and surface water, with current permitted amounts sufficient to meet demands into 2040. The plan, however, does not include existing poultry farms in their assessments. While the seafood industry could also show future growth in the region, Section 4.0 of the ANPDC Groundwater Management Plan details industrial water for seafood and poultry processing, noting over 90% of industrial groundwater usage is related to poultry processing. WSP Staff note existing water quality concerns for surface waters and no significant water surpluses or sources in Accomack County to serve as alternative sources. Additionally, WSP staff reviewed the current alternatives under consideration, such as water table wells, and noted that the ability of the National Resources Conservation Service's (NRCS) Environmental Quality Incentives Program (EQIP) program to fund such efforts is currently unknown. The current lack of inclusion of poultry in the region's plan, existing water quality and alternative source concerns, and the unknown status of funding for alternative development underlines potential regional resource concerns to be addressed in future planning efforts.

DEQ Recommended Withdrawal Limits: The recommended withdrawal limits are based on the total of both consumption (drinking water) and cooling. Water use for consumption was evaluated based on meter data from the farm. DEQ staff evaluated the water use from previous flocks, compared it to the standard industry formulas developed for the area, and determined the values provided a reasonable basis for estimating annual and monthly withdrawal amounts.

DEQ staff evaluated the volumes requested for cooling and determined they were accurately calculated using the procedure discussed in more detail above. Given the lack of data available for evaluating poultry water use in the area and the agreement between Thornton Farm's flock data and estimates and those developed for the area, DEQ believes the methods employed are conservative enough to provide sufficient water for the farm to continue operation while still providing a reasonable limit for the permits. It is expected that as more metered data becomes available, withdrawal limits may be reduced in cases where actual water use is significantly lower than the permit limits.

Withdrawal limits were rounded to nearest hundred thousand in accordance with DEQ's April 6, 2015 "Rounding Memo". DEQ recommends the following withdrawal volumes based upon evaluation of the groundwater withdrawal permit application.

Period of Withdrawal	Actual Volume (gal.)	Volume in MGD
Maximum Monthly:	1,900,000	.061
Maximum Annual:	8,040,000	.022

Technical Evaluation: Aquaveo, LLC performed a technical evaluation of the application for the Department based on the VAHydroGW-ES model. As an aquifer pump test was not performed, the properties from the VAHydroGW-ES model were used to simulate the potential drawdown resulting from the proposed withdrawal. The model uses a base simulation which includes all existing permits (except the applicant wells) operating at their 2017 maximum annual withdrawal limit allowed under the terms of their permit for all Ground Water Management Area (GWMA) permit holders. This base simulation is then executed for 50 years. A second 50-year simulation was then conducted using the VAHydroGW-ES model with the applicant's proposed withdrawals added to the base simulation to simulate drawdown resulting from the applicant's wells using the proposed withdrawal volumes. The objectives of this evaluation were to determine the areas of any aquifers that will experience at least one foot of water level decline due to the proposed withdrawal (the Area of Impact or AOI), to determine the potential for the proposed withdrawal to cause salt-water intrusion, and to determine if the proposed withdrawal meets the 80% drawdown criteria. A summary of the results of the evaluation are provided below and the full technical evaluation is attached to this fact sheet as Attachment 1.

Aquaveo, LLC reviewed and compared simulated 2017 water levels from the reported use to USGS measured water levels in observation wells closest to the applicant's withdrawal for the same year for the Upper, Middle, and Lower Yorktown-Eastover aquifers. Comparing the VAHydroGW-ES 2017 Historic Use Water Level with the USGS Network Well 2017 Water Level provides a method for judging the accuracy of the VAHydroGW-ES model. They noted that the water levels obtained from the regional observation networks for the Upper, Middle, and Lower Yorktown-Eastover aquifers each fall within 2-6 feet of simulated values. Aquaveo also noted that the observed water levels in all three aquifers exhibit yearly fluctuations in water levels of approximately 2 to 4 ft. in the Upper, Middle, and Lower Yorktown-Eastover. Water levels simulated by the VAHydroGW-ES do not fluctuate in the same manner because the pumping and recharge simulated in the model for any given year are averaged over the year and entered in the model as the average value for the year. Aquaveo concluded that while there are some variations between the observed and simulated water levels, the fluctuations and general patterns observed in the USGS wells are simulated by the VAHydroGW-ES model and the water levels from the two sources are in general agreement for the Upper, Middle, and Lower Yorktown-Eastover. Differences between observed and simulated water levels will be noted and addressed during the next calibration of the VAHydroGW-ES model.

The potential for adverse changes to water quality due to increases salinity resulting from the proposed withdrawal was evaluated using transient, density-dependent, SEAWAT simulations using the VAHydroGW-ES. The results indicated that no model cells simulate an increase in chloride concentration greater than 20 mg/L due to the proposed withdrawal. Therefore, the VAHydroGW-ES model results do not indicate the potential for reduced water quality.

The results of the VAHydroGW-ES simulations predict areas of impact due to the proposed withdrawal in the Middle and Lower Yorktown-Eastover aquifers. The Area of Impact (AOI), or the area in which the withdrawal is expected to result in a drawdown of at least 1 foot, extend a maximum distance of approximately 0.4 and 0.3 miles from the production center in the Middle and Lower Yorktown-Eastover aquifers, respectively. As the AOI extends off of the property line, a mitigation plan was required to be incorporated into the permit. The modeled area of impact determines the area for which the facility must mitigate any impacts according to the mitigation plan incorporated into this permit.

With the inclusion of the proposed withdrawal, the model simulated water levels -6.8, -12.0, and -11.4 ft. mls for the Upper, Middle, and Lower Yorktown-Eastover aquifers, respectively. The 80% drawdown criterion allows the potentiometric water level (based on the critical surface elevation calculated from the VAHydroGW-ES data) to be reduced to -71.5, -139.7, and -187.4 ft. msl for the Upper, Middle, and Lower Yorktown-Eastover aquifers, respectively. Therefore, the water levels in the VAHydroGW-ES cell containing the applicant wells for each confined aquifer are not simulated to fall below the critical surface. Additionally, no new VAHydroGW-ES cells are simulated to have water levels fall below the critical surface. Therefore, this withdrawal is within the limits set by the 80% drawdown criterion.

Aquaveo, LLC concluded that the proposed withdrawals meet technical criteria for permit issuance. Maps of the AOIs are included in the attached Mitigation Plan.

Part I Operating Conditions

Authorized Withdrawals:

Owner Well Name	DEQ Well #	Aquifer*	Type	Max Pump Setting (ft. bls)*
Well 1	100-01328	Middle Yorktown-Eastover	Production	219
Well 2	100-01329	Middle Yorktown-Eastover	Production	219
Well 3	100-01330	Middle Yorktown-Eastover	Production	219
Well 4	100-01331	Middle Yorktown-Eastover	Production	219
Well 5	100-01332	Middle Yorktown-Eastover	Production	219
Well 6	100-01333	Middle Yorktown-Eastover	Production	219

*Max pump settings were estimated based on the USGS Eastern Shore Hydrogeologic Framework and will be updated using site-specific geophysical data collected as required by the permit.

Apportionment:

The technical evaluation analysis indicated that the apportionment of the requested withdrawal amount among the applicant production wells had no significant effect on the outcome of the technical evaluation. Given this determination, apportionment limits have not been incorporated into the permit.

Additional Wells

There are no additional observation, abandoned, or out of service wells associated with this facility.

Pump Intake Settings:

The pump intake for Wells #1 through #5 are, per a handwritten note on the GW-2 forms, set at 200 ft bls. The pump intake for Well #6 is noted to be set at 150 ft bls on the GW-2 form for this well. No geophysical log was available for this site and therefore aquifer elevation for the tops of the aquifers in use were estimated using the USGS Eastern Shore Hydrogeologic Framework. Once geophysical log data is obtained in compliance with the

permit, DEQ geologists will determine the top of the aquifer in use, which will be the pump intake limit above which the pumps must be set. The permittee will have 90 days to ensure all pumps meet the intake limits once notified of the limits by DEQ.

Withdrawal Reporting:

Groundwater withdrawals are to be recorded monthly and reported quarterly.

Water Conservation and Management Plan:

A Water Conservation and Management Plan (WCMP) meeting the requirements of 9VAC25-610-100.B was submitted and reviewed as part of the application process. The accepted Plan is to be followed by the permittee as an operational Plan for the facility/water system.

- A detailed description of the leak detection and repair program activities and documentation to the Department that these activities have been conducted is due by the end of the first year of the permit term.
- A result of a 12 month audit of the total amount of groundwater used in the distribution system and the amounts for drinking and cooling water, documentation of the flock cycle start and end dates, and any necessary changes to the operation affecting water use is due by the end of the second year of the permit term.
- A report on the plan's effectiveness in maintaining or reducing water use amounts needed, including revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to date shall be submitted by the end of years five (Mo Dy, 2024) and ten (Mo Dy, 2029) of the permit term.

Mitigation Plan:

The predicted AOI resulting from the Technical Evaluation extends beyond the property boundaries in the Middle and Lower Yorktown-Eastover aquifers. Given this prediction, a Mitigation Plan to address potential claims from existing well owners within the predicted area of impact is included in the permit by reference.

Well Tags:

Well tags will be transmitted with the final permit.

Part II Special Conditions

Geophysical Log Data Collection:

Geophysical log information is needed to evaluate the top of the aquifer in use and the regulatory permitted pump intake limit, and to determine whether the current pump settings meet regulatory limitations. The Department requires collection of a geophysical log for each new well to be included in a Groundwater Withdrawal Permit. Given the large number of wells associated with poultry facilities, the Department agreed to

work with applicants that had constructed wells prior to application to allow for a reduced number of geophysical logs required to represent the wells keeping in mind the need to evaluate lateral variation in the hydrogeology. The Permittee must contact DEQ at least two months prior to scheduling the geophysical logs to allow for Department scheduling.

The collection of geophysical log data requires a borehole to be drilled at least to the depth of the deepest facility well, or an alternative depth at the discretion of the Department, and the logging equipment run down the full depth of the hole. Geophysical logging is to include 16"/64" Normal, Single Point, Self-Potential, and Natural Gamma at a scale of 20 feet per inch. Collection of a full suite of geophysical logs and a drillers log is required by June 30, 2024 at two locations with the locations and depths approved by DEQ. Additional geophysical log locations may be required by Department staff as warranted depending on site hydrogeology to evaluate lateral variation in the aquifer top elevations. These logs will be used to represent the remaining facility wells. Department staff must be present for the geophysical logging to evaluate the log and well cuttings.

Pump Intake Determination and Reset:

Within 90 days of notification of pump intake limits by the Department based on the geophysical data, the permittee shall ensure all pump intakes are set above the identified limits. The Permittee is to notify the Department of the work schedule and to submit written documentation of the pump setting within 30 days of the work.

Meter Installation/Verification:

The wells are plumbed together but each well is individually metered with an in-line meter prior to treatment and use in the chicken houses. In cases where meters are found to be incorrectly installed or otherwise failing to capture the total water use of each well, DEQ will notify the permittee of such via an inspection report and the permittee shall correct any meter issues within 60 days.

Unknown Well Construction:

Well Construction information was not available for the Well #2, DEQ Well #100-01329. A camera survey will be required to determine well construction information and document the pump intake depth. DEQ shall be notified at least two weeks prior to any camera survey being conducted to allow Department staff to be present during the camera survey. A video recording of the camera survey is required for each surveyed well. Surveys where the well and screen depths, and the pump intake depth cannot be confidently determined will not be accepted by the Department.

Alternative Source Investigation:

The facility is supplied by wells screened in the confined Upper, Middle, and Lower Yorktown-Eastover aquifer. The confined aquifer system on the Eastern Shore is considered to be of higher quality than the surficial (water table) aquifer and is the potable water supply for the majority of the Eastern Shore. The regulation requires the lowest quality water available be applied to the permitted use. While the application states generally that the surficial aquifer would not be viable, site specific investigation is necessary to evaluate the surficial aquifer quality and availability. Within 5 years (September 30, 2025) of permit issuance, an alternative source investigation must be completed and the results submitted to DEQ for review and acceptance.

The investigation shall provide pump test and water quality data from a test or production well screened in the surficial aquifer on the facility site as well as conclusions on the capability of the surficial aquifer to supply all or part of the water needs for the facility.

Part III General Conditions

General Conditions are applied to all Groundwater Withdrawal Permits, as stated in the Groundwater Withdrawal Regulations, 9VAC25-610-10 *et seq.*

Public Comment

The following sections will be completed after close of the public comment period.

Relevant Regulatory Agency Comments:

Summary of VDH Comments and Actions: This facility is not a public water supply so soliciting comments from VDH was not required.

Public Involvement during Application Process:

Local and Area wide Planning Requirements: The Accomack County Administrator indicated on April 3, 2018 that the facility's operations are consistent with all ordinances.

Public Comment/Meetings: The public notice was published in the Eastern Shore Post on Mo Dy, 2019. The public comment period ran from Mo Dy, 2019 to Mo Dy, 2019.

Changes in Permit Part II Due to Public Comments

Changes in Permit Part III Due to Public Comments

Staff Findings and Recommendations

Based on review of the permit application, staff provides the following findings.

- The proposed activity is consistent with the provisions of the Ground Water Management Act of 1992, and will protect other beneficial uses.
- The proposed permit addresses minimization of the amount of groundwater needed to provide the intended beneficial use.
- The effect of the impact will not cause or contribute to significant impairment of state waters.
- This permit includes a plan to mitigate adverse impacts on existing groundwater users.

Staff recommends Groundwater Withdrawal Permit Number GW0072800 be issued as proposed.

Attachments

- 1. Technical Evaluation**
- 2. Water Conservation Plan**
- 3. Mitigation Plan**
- 4. Water Use Calculations**
- 5. Public Comment Sheet**

Approved: _____
Director, Office of Water Supply

Date: _____

**COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY**

TECHNICAL EVALUATION FOR PROPOSED GROUNDWATER WITHDRAWAL

Date: December 14, 2018

Application /Permit Number: GW0072800

Owner / Applicant Name: Edward Thornton

Facility / System Name: Ed, Pat, and Brandy Sue Farm

Facility Type: Agriculture – Poultry Farm

Facility / System Location: Accomack County

The Commonwealth of Virginia’s Groundwater Withdrawal Regulations (9VAC25-610-110(D) state that, for a permit to be issued for a new withdrawal, to expand an existing withdrawal, or reapply for a current withdrawal, a technical evaluation shall be conducted. This report documents the results of the technical evaluation conducted to meet the requirements for the issuance of a permit to withdrawal groundwater within a Groundwater Management Area as defined in (9VAC25-600-10 et seq.).

This evaluation determines the:

- (1) The Area of Impact (AOI): The AOI for an aquifer is the areal extent of each aquifer where one foot or more of drawdown is predicted to occur as a result of the proposed withdrawal.
- (2) Water Quality: The potential for the proposed withdrawal to cause salt water intrusion into any portions of any aquifers or the movement of waters of lower quality to areas where such movement would result in adverse impacts on existing groundwater users or the groundwater resource as per (9VAC25-610-110(D)(2), and
- (3) The Eighty Percent Drawdown (80% Drawdown): The proposed withdrawal in combination with all existing lawful withdrawals will not lower water levels, in any confined aquifer that the withdrawal impacts, below a point that represents 80% of the distance between the land surface and the top of the aquifer at the points where the one-foot drawdown contour is predicted for the proposed withdrawal as per 9VAC25-610-110(D)(3)(h).

Summary of Requested Withdrawal:

General:

In response to the Department of Environmental Quality’s (DEQ) Compliance Assistance Framework initiative, a cohort of poultry farms in Accomack County were identified as potentially requiring a groundwater withdrawal permit (GWWP). The farms primarily grow broilers which are processed by several poultry integrators located in the area. These farms use groundwater to provide drinking water to the birds as well as to supply water to either misting systems or evaporative cooling pads which cool the birds. Cooling is primarily required in summer. Most wells associated with poultry farms in Accomack County are screened in either the upper, middle, or lower Yorktown-Eastover aquifers. The use of the Columbia (water-table) aquifer is being investigated by the industry and this aquifer may be used in the future to augment withdrawals from confined aquifers where possible.

Water use for poultry farms varies seasonally as well as in response to the poultry life cycle. Generally during winter, fall, and spring, facility withdrawals rise and fall in a fairly predictable pattern every 50-60 days, with usage primarily resulting from water consumption. This pattern starts with low water

consumption volumes for chick development and maxes out in the last 20-30 days as breeders seek to maximize adult weight gains. Typically, farms raise around five flocks per year with this cycle repeating each time. During the summer, withdrawal volumes increase due to additional water usage for flock cooling purposes. A few farms have additional sanitary and other agricultural uses (crops/other livestock).

Facility Specific:

Ed, Pat, and Brandy Sue Farm has 8 poultry houses and 6 production wells. The houses are: 5 houses at 40' widths and 3 houses at 50' widths. Proposed withdrawal limits were calculated based on the total of both consumption (drinking water) and cooling. Water use for consumption was calculated based on limited meter data and consultant and DEQ calculation formats. Water use for cooling was calculated based on estimates established on house size and cooling fan capacity.

Volumes include additional usage for onsite residential sanitary usage and other agricultural uses (cattle).

The proposed withdrawal limits and well construction details are as follows:

Proposed Withdrawal Limits:

Proposed Withdrawal Limits	
Annual Value	8,000,000 (21,918 average gpd)
Monthly Value	1,800,000 (58,065 average gpd)

Proposed Apportionment of Withdrawal:

Due to the well/plumbing configuration, the withdrawal will be apportioned fairly equally between the system wells.

Production Well(s):

Identification	Location	Construction	Pump Intake	Source Aquifer
Owner Well Name: Well #1 DEQ Well Number: 100- 01328 MPID: 375321075323801	Lat: 37°53' 20.70" Lon: -75° 32' 38.32" Datum: NAD27 Elevation: 42	Completion Date: 5/30/1995 Screens (ft-bls): 235-255 Total Depth (ft-bls): 255	200	Middle Yorktown- Eastover
Owner Well Name: Well #2 DEQ Well Number: 100- 01329 MPID: 375321075324002	Lat: 37°53' 20.60" Lon: -75° 32' 39.72" Datum: NAD27 Elevation: 42	Completion Date: unknown, approx. 1995 Screens (ft-bls): 235-255* Total Depth (ft-bls): 255*	200	Middle Yorktown- Eastover expected

Owner Well Name: Well #3 DEQ Well Number: 100- 01330 MPID: 375321075323303	Lat: 37°53' 20.76" Lon: -75° 32' 33.36" Datum: NAD27 Elevation: 40	Completion Date: 8/24/2009 Screens (ft-bls): 210-220 Total Depth (ft-bls): 220	200	Middle Yorktown- Eastover
Owner Well Name: Well #4 DEQ Well Number: 100- 01331 MPID: 375320075323104	Lat: 37°53' 20.40" Lon: -75° 32' 30.84" Datum: NAD27 Elevation: 40	Completion Date: 9/20/2004 Screens (ft-bls): 240-260 Total Depth (ft-bls): 260	200	Middle Yorktown- Eastover
Owner Well Name: Well #5 DEQ Well Number: 100- 01332 MPID: 375324075323105	Lat: 37°53' 24.0" Lon: -75° 32' 30.84" Datum: NAD27 Elevation: 40	Completion Date: 9/20/2004 Screens (ft-bls): 240-260 Total Depth (ft-bls): 260	200	Middle Yorktown- Eastover
Owner Well Name: Well #6 DEQ Well Number: 100- 01333 MPID: 375322075323006	Lat: 37°53' 22.20" Lon: -75° 32' 29.76" Datum: NAD27 Elevation: 40	Completion Date: 6/14/2016 Screens (ft-bls): 225-240 Total Depth (ft-bls): 240	150	Middle Yorktown- Eastover

* No well construction information located. Well Construction information estimated based on Well #1.

Geologic Setting:

The Ed, Pat, and Brandy Sue Farm wells (applicant wells) are located in northern Accomack County. The production wells are screened in the Middle Yorktown-Eastover aquifer. The upper portion of the Yorktown-Eastover aquifer (described in the 2006 Virginia Coastal Plain Hydrologic Framework¹ (VCPHF) as a combination of the Upper, Middle, and Lower Yorktown-Eastover aquifers) is composed primarily of estuarine to marine quartz sands of the Yorktown Formation of Pliocene age. The nearest USGS geologic cross section found in USGS Professional Paper 1731 is cross-section GS-GS' (see attached figure at the end of the report).

¹ McFarland, E.R., and Bruce, T.S., 2006, The Virginia Coastal Plain Hydrogeologic Framework: U.S. Geological Survey Professional Paper 1731, 118 p., 25 pls.

Virginia Eastern Shore Model data:

The following table lists the location of the applicant production wells within the Virginia Eastern Shore Model² (VAHydroGW-ES).

VAHydroGW-ES Model Grid				
Well	Well Number	MPID	Row	Column
Well #1	100-01328	375321075323801	58	57
Well #2	100-01329	375321075324002	58	57
Well #3	100-01330	375321075323303	58	57
Well #4	100-01331	375320075323104	58	57
Well #5	100-01332	375324075323105	58	57
Well #6	100-01333	375322075323006	58	57

Hydrologic Framework:

Data from the VCPHF is reported in this technical report to illustrate the hydrogeologic characteristics of the aquifers in the Virginia Eastern Shore near the applicant wells and identify major discrepancies between regional hydrogeology and site logs interpreted by the DEQ staff geologist.

The following average aquifer elevations were estimated from the VAHydroGW-ES at the model cell(s) containing the applicant production wells.

VAHydroGW-ES Average Hydrologic Unit Information		
Aquifer	Elevation (feet msl)	Depth (feet bls)
Surface	40	0
Columbia aquifer (bottom)	-31	71
Upper Yorktown-Eastover aquifer (top)	-94	134
Upper Yorktown-Eastover aquifer (bottom)	-139	179
Middle Yorktown-Eastover aquifer (top)	-179	219
Middle Yorktown-Eastover aquifer (bottom)	-210	250
Lower Yorktown-Eastover aquifer (top)	-238	278
Lower Yorktown-Eastover aquifer (bottom)	-341	381

Eastern Shore Hydrogeologic Framework Based Recommendations:

Due to a lack of geophysical borehole data, DEQ staff has reviewed available information and made the following preliminary determinations regarding the location of the aquifer tops for the following wells based upon a review of the GW-2 forms available and The Virginia Coastal Plain Hydrogeologic Framework (USGS Professional Paper 1731). Further evaluation of aquifer tops will be conducted during the upcoming permit term and as additional geophysical information becomes available.

² Sanford, W.E., Pope, J.P., and Nelms, D.L., 2009, Simulation of groundwater-level and salinity changes in the Eastern Shore, Virginia: U.S. Geological Survey Scientific Investigations Report 2009-5066, 125 p.

Unit	Well #1-6 (ft-bls)
Top of Upper Yorktown-Eastover	132
Top of the Middle Yorktown-Eastover	217
Top of the Lower Yorktown-Eastover	277

Water Level Comparison:

Below water levels retrieved from the USGS regional observation network wells are compared to the simulated water levels reported in the *Virginia Eastern Shore 2017-2018 Annual Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use* report (the 2017-2018 report) and simulation files.³ This comparison is made in order to evaluate the performance of the regional model in the vicinity of the applicant wells and assess historical groundwater trends.

The 2017-2018 report provides two sets of simulated potentiometric water surface elevations. The VAHydroGW-ES model is divided into three parts. The first portion of the model simulates water levels within the Eastern Shore aquifers from 1900 through 2017 based upon historically reported pumping amounts (the “*Historic Use Simulation*”). This portion of the model has been calibrated to match water levels observed in USGS regional observation network wells situated throughout the peninsula. The water levels reported in the 2017-2018 report are based upon two separate simulations, each simulation running from 2018 through 2067. The simulated pumping amount in these two simulations are based upon, 1) the average 2013-2017 reported withdrawal amount of wells in the VAHydroGW-ES model (the “*Reported Use Simulation*”) and, 2) the current (2018) maximum withdrawal amount allowed under their current permit for wells in the VAHydroGW-ES model (the “*Total Permitted Simulation*”). Both these simulations are an extension of the *Historic Use Simulation* and the water levels reported in the 2017-2018 report are the final water levels simulated at the end of the simulations (2067).

The “VAHydroGW-ES 2067 Reported Use Water Level,” reported in the tables below, is the simulated water level – 50 years from present – if all permitted pumping continued at the average 2013-2017 reported withdrawal amount for the next 50 years. And the “VAHydroGW-ES 2067 Total Permitted Water Level,” reported in the tables below, is the simulated water level – 50 years from present – if all Eastern Shore permitted wells were to pump at the maximum permitted amount allowed under their current permit for the next 50 years. Finally, the “VAHydroGW-ES 2017 Historic Use Water Level,” reported in the tables below, is the water level simulated for the year 2017 in the *Historic Use Simulation*.

The nearest USGS regional observation network wells to the applicant wells, completed in the Upper, Middle, or Lower Yorktown-Eastover aquifers, are listed in the following tables and shown in Figure 1. For the USGS regional observation network wells, average 2017 reported water levels are shown in the following tables. Simulated water levels for the Upper, Middle, and Lower Yorktown-Eastover aquifers, for the VAHydroGW-ES cells containing the USGS regional observation network wells are also shown in the following tables.

³ See *Virginia Eastern Shore 2017-2018 Annual Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use* report and simulation files on file with the VA DEQ.

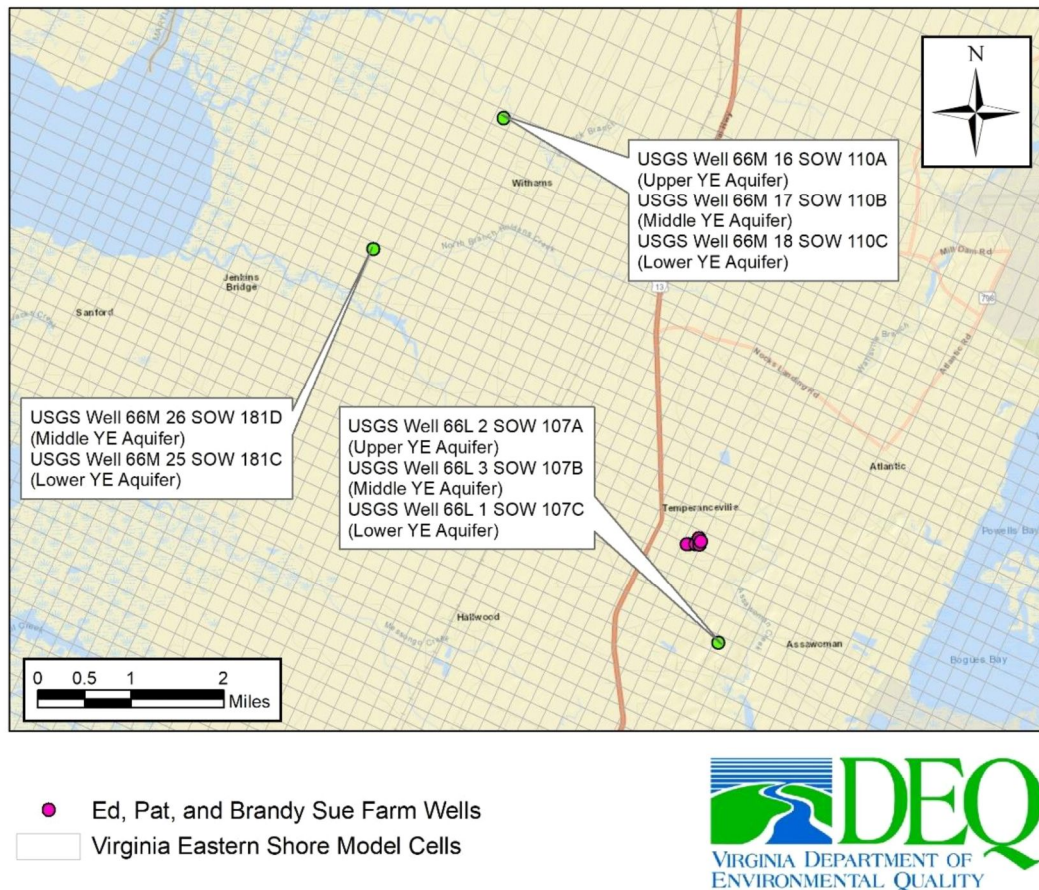


Figure 1. Nearest USGS regional observation network wells.

Comparing the VAHydroGW-ES 2017 Historic Use Water Level with the USGS Network Well 2017 Water Level provides a method for judging the accuracy of the VAHydroGW-ES. Figures 2 through 9 show graphs of the recorded water levels from the USGS observation wells listed in the following tables. These figures also show the simulated VAHydroGW-ES *Historic Use Simulation* water levels for the model cell containing each USGS well. Observing the simulated and observed water elevations together provide a second method for assessing the accuracy of the VAHydroGW-ES in the vicinity of the applicant wells.

The Upper Yorktown-Eastover VAHydroGW-ES 2017 Reported Use Water Level is the same value as the USGS Network Well 2017 Water Level observed in Well 66L 2 SOW 107A; while the 2017 VAHydroGW-ES water level is a few feet higher than the level observed in Well 66M 16 SOW 110A. The water levels observed over the past approximately 40 years in both Upper Yorktown-Eastover USGS wells are shown in Figures 2 and 3. Both wells exhibit yearly fluctuations in water levels of approximately 2 to 4 feet. Water levels simulated by the VAHydroGW-ES do not fluctuate in the same manner because the pumping and recharge simulated in the model for any given year are averaged over the year and entered in the model as the average value for the year. Water levels for Well 66L 2 SOW 107A are in general agreement with the water level simulated by the VAHydroGW-ES. Water levels for Well 66M 16 SOW 110A are approximately 4 feet lower for the period of record than those simulated by the VAHydroGW-ES.

The Middle Yorktown-Eastover VAHydroGW-ES 2017 Reported Use Water Levels are one-half to six feet lower than the USGS Network Well 2017 Water Levels observed in Well 66L 3 SOW 107B, Well 66M 17 SOW 110B, and Well 66M 26 SOW 181D. The water levels observed over the past 30 to 40 years in the Middle Yorktown-Eastover USGS wells are shown in Figures 4 through 6. Each well exhibits yearly fluctuations in water levels of approximately 2 to 4 feet. Water levels for the USGS Middle Yorktown-

Eastover wells are in general agreement with the water level simulated by the VAHydroGW-ES – especially for wells 66L 3 SOW 107B and 66M 17 SOW 110B. While still reasonably accurate, water levels for 66M 26 SOW 181D are lower than and have diverged slightly from those simulated by the VAHydroGW-ES over the past 15 years.

The Lower Yorktown-Eastover VAHydroGW-ES 2017 Reported Use Water Levels are one to five feet lower than the USGS Network Well 2017 Water Levels observed in Well 66L 1 SOW 107C, Well 66M 18 SOW 110C, and Well 66M 25 SOW 181C. The water levels observed over the past 30 to 40 years in the Lower Yorktown-Eastover USGS wells are shown in Figures 7 through 9. Each well exhibits yearly fluctuations in water levels of approximately 2 to 4 feet. Water levels for the USGS Lower Yorktown-Eastover wells are in general agreement with the water level simulated by the VAHydroGW-ES.

Differences between observed and simulated water levels will be noted and addressed during the next calibration of the VAHydroGW-ES.

Upper Yorktown-Eastover Measurements	66L 2 SOW 107A	66M 16 SOW 110A
Distance from applicant wells (miles)	1.1	5.1
VAHydroGW-ES Row	63	41
VAHydroGW-ES Column	61	37
VAHydroGW-ES Land Surface Elevation (ft-msl)	27	10
USGS Well Land Surface Elevation (ft-msl)	10	11
USGS Network Well 2017 Water Level (ft-msl)	0.9	1.1
VAHydroGW-ES 2017 Reported Use Water Level (ft-msl)	0.9	4.5
VAHydroGW-ES 2067 Reported Use Water Level (ft-msl)	0.2	4.5
VAHydroGW-ES 2067 Total Permitted Water Level (ft-msl)	-0.9	4.5

Middle Yorktown-Eastover Measurements	66L 3 SOW 107B	66M 17 SOW 110B	66M 26 SOW 181D
Distance from applicant wells (miles)	1.1	5.1	4.7
VAHydroGW-ES Row	63	41	51
VAHydroGW-ES Column	61	37	33
VAHydroGW-ES Land Surface Elevation (ft-msl)	27	10	6
Land Surface Elevation (ft-msl)	10	11	6
USGS Network Well 2017 Water Level (ft-msl)	0.5	0.3	5.0
VAHydroGW-ES 2017 Reported Use Water Level (ft-msl)	0.0	-1.0	-1.1
VAHydroGW-ES 2067 Reported Use Water Level (ft-msl)	-0.7	-2.1	-1.7
VAHydroGW-ES 2067 Total Permitted Water Level (ft-msl)	-31.4	-2.7	-2.1

Lower Yorktown-Eastover Measurements	66L 1 SOW 107C	66M 18 SOW 110C	66M 25 SOW 181C
Distance from applicant wells (miles)	1.1	5.1	4.7
VAHydroGW-ES Row	63	41	51
VAHydroGW-ES Column	61	37	33
VAHydroGW-ES Land Surface Elevation (ft-msl)	27	10	6
Land Surface Elevation (ft-msl)	10	11	6
USGS Network Well 2017 Water Level (ft-msl)	-0.9	-0.3	2.1
VAHydroGW-ES 2017 Reported Use Water Level (ft-msl)	0.0	-1.1	-1.1
VAHydroGW-ES 2067 Reported Use Water Level (ft-msl)	-0.8	-2.2	-1.7
VAHydroGW-ES 2067 Total Permitted Water Level (ft-msl)	-1.9	-2.8	-2.2

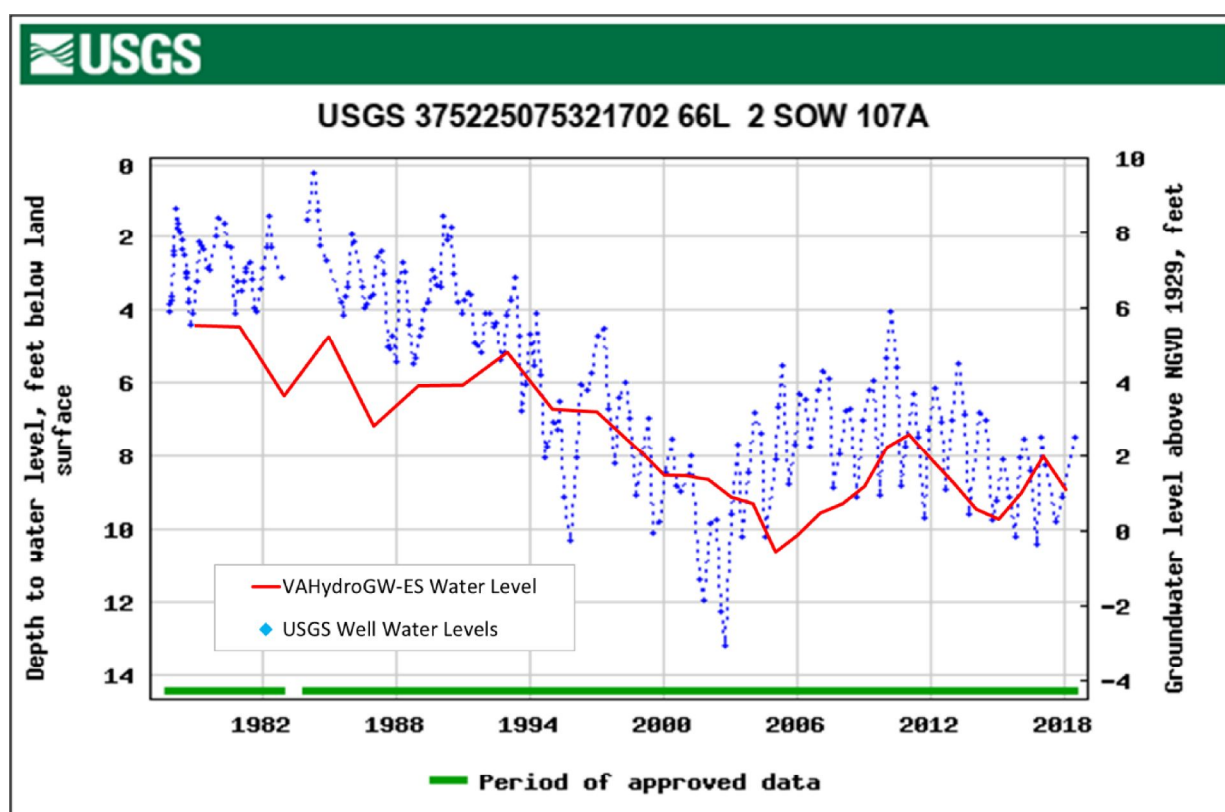


Figure 2. USGS Regional Observation Well 66L 2 SOW 107A, Upper Yorktown-Eastover aquifer water levels recorded from 1977 to present (well depth 140 ft bls, land surface 10 ft msl).

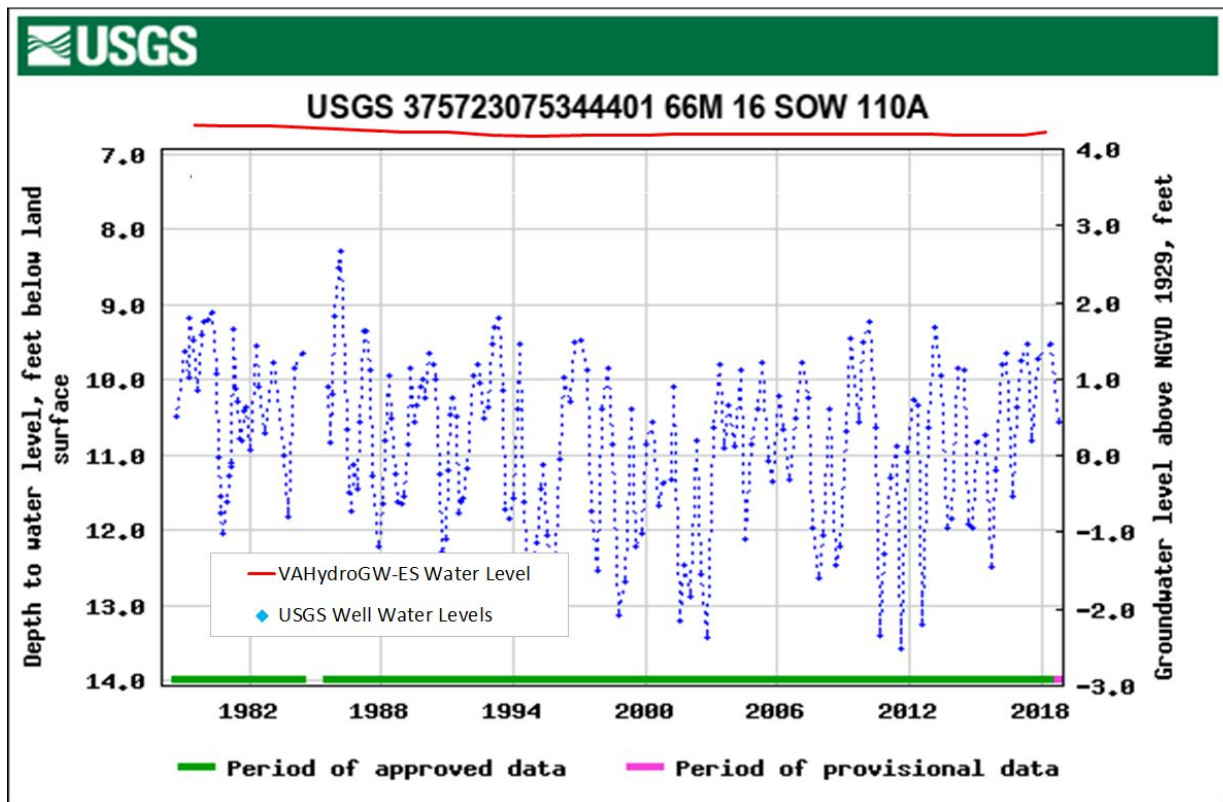


Figure 3. USGS Regional Observation Well 66M 16 SOW 110A, Upper Yorktown-Eastover aquifer water levels recorded from 1978 to present (well depth 130 ft bls, land surface 11 ft msl).

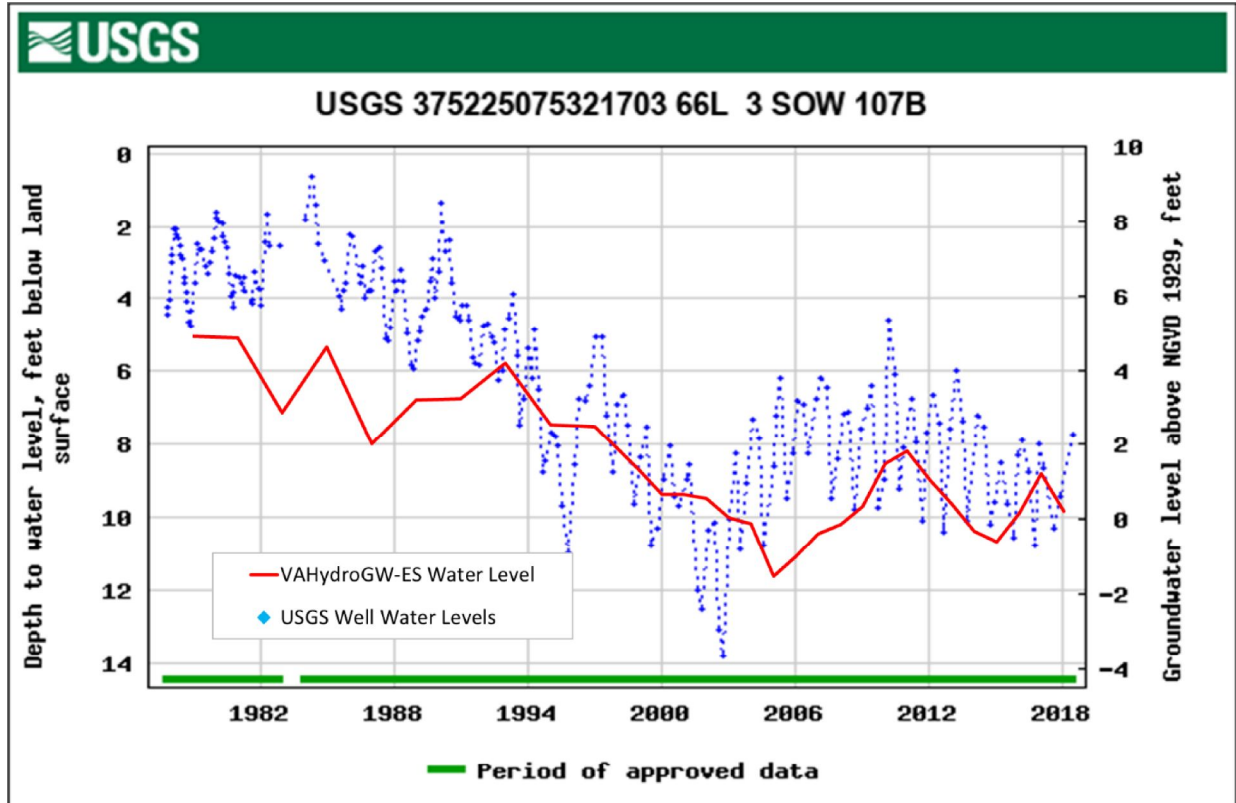


Figure 4. USGS Regional Observation Well 66L 3 SOW 107B, Middle Yorktown-Eastover aquifer water levels recorded from 1977 to present (well depth 206 ft bls, land surface 10 ft msl).

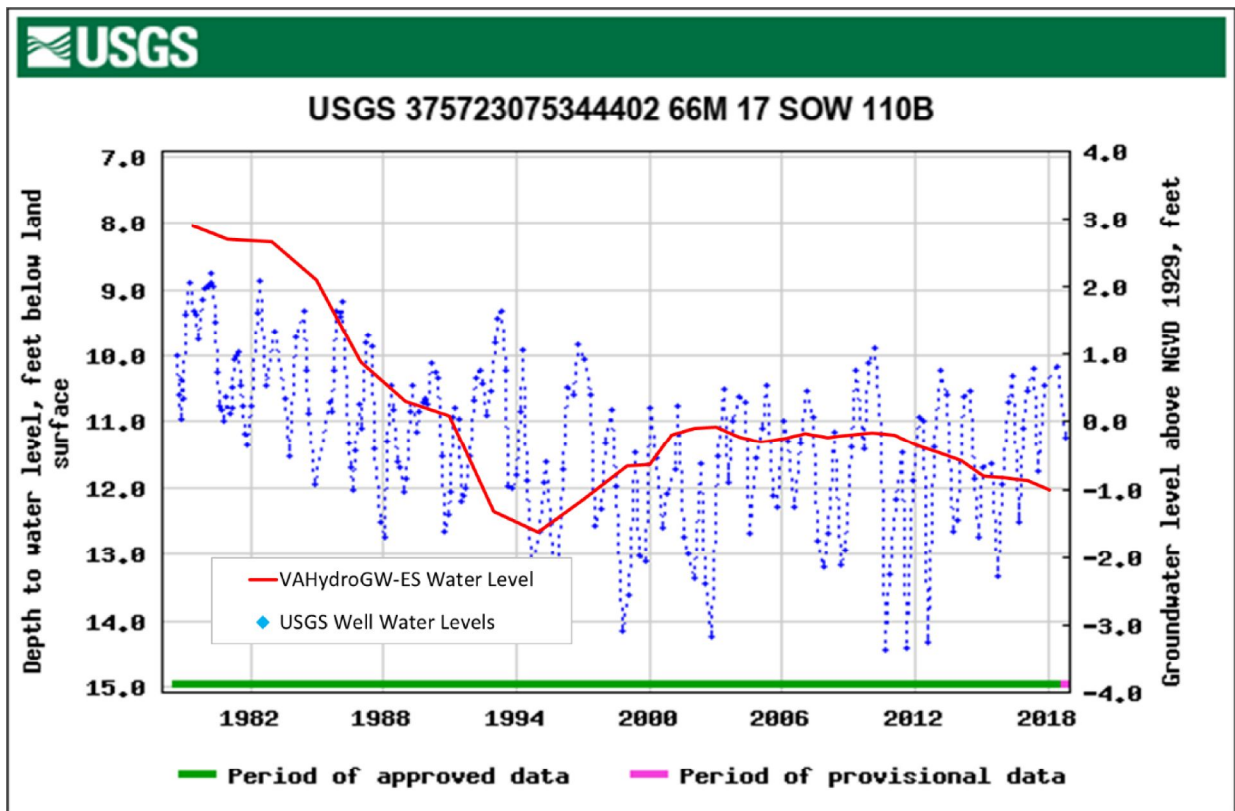


Figure 5. USGS Regional Observation Well 66M 17 SOW 110B, Middle Yorktown-Eastover aquifer water levels recorded from 1978 to present (well depth 178 ft bls, land surface 11 ft msl).

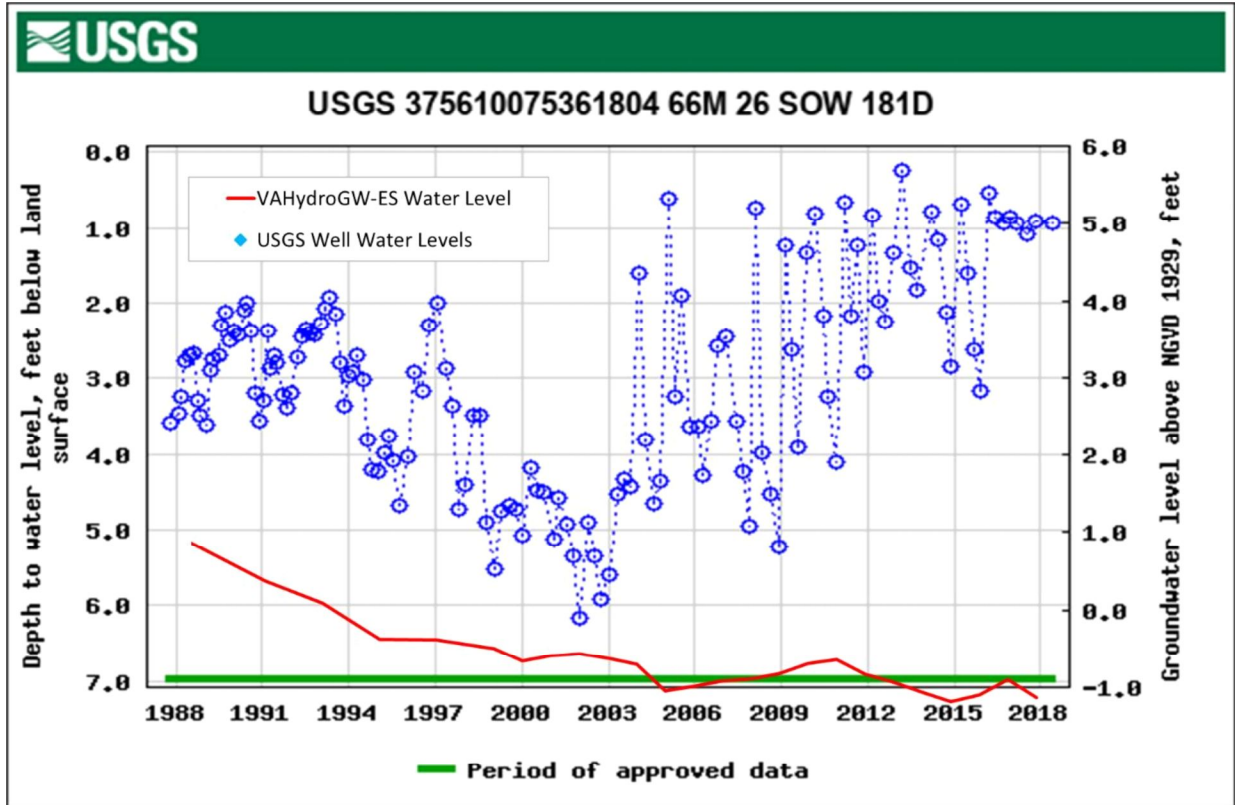


Figure 6. USGS Regional Observation Well 66M 26 SOW 181D, Middle Yorktown-Eastover aquifer water levels recorded from 1987 to present (well depth 230 ft bls, land surface 6 ft msl).

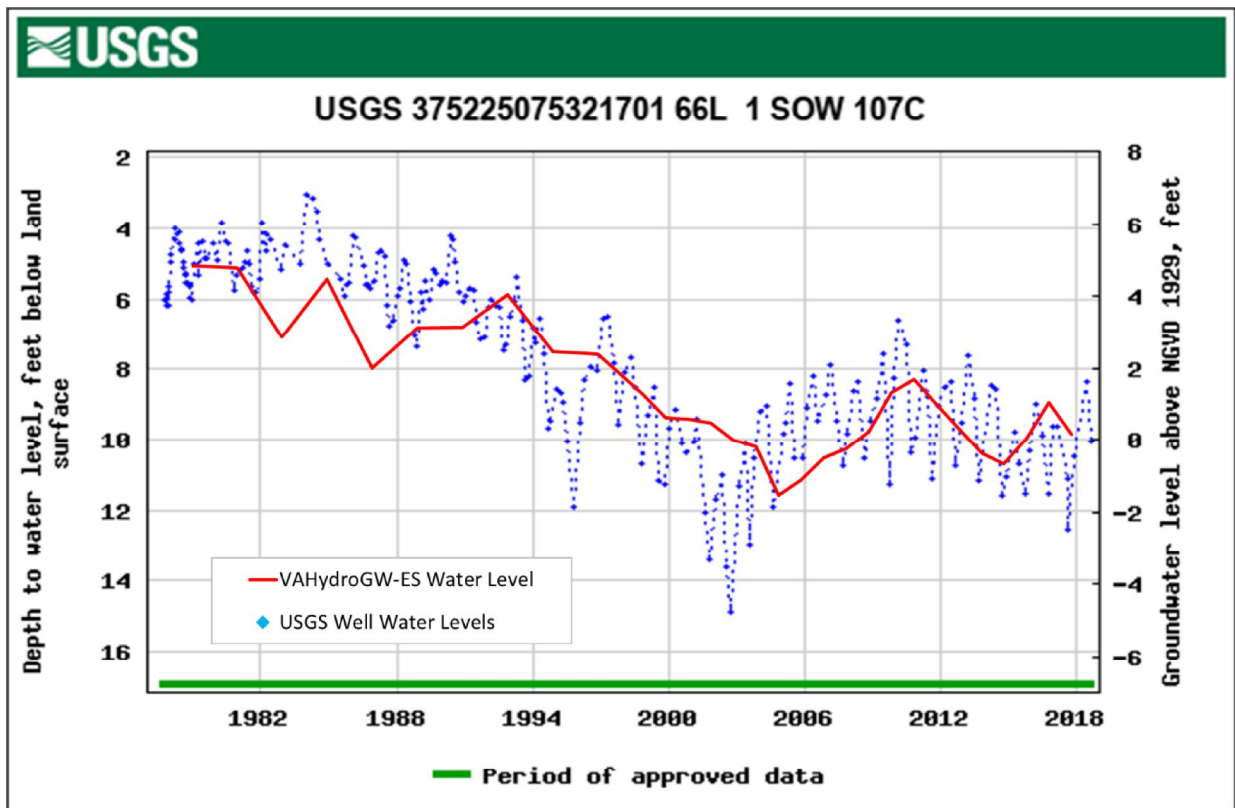


Figure 7. USGS Regional Observation Well 66L 1 SOW 107C, Lower Yorktown-Eastover aquifer water levels recorded from 1977 to present (well depth 305 ft bls, land surface 10 ft msl).

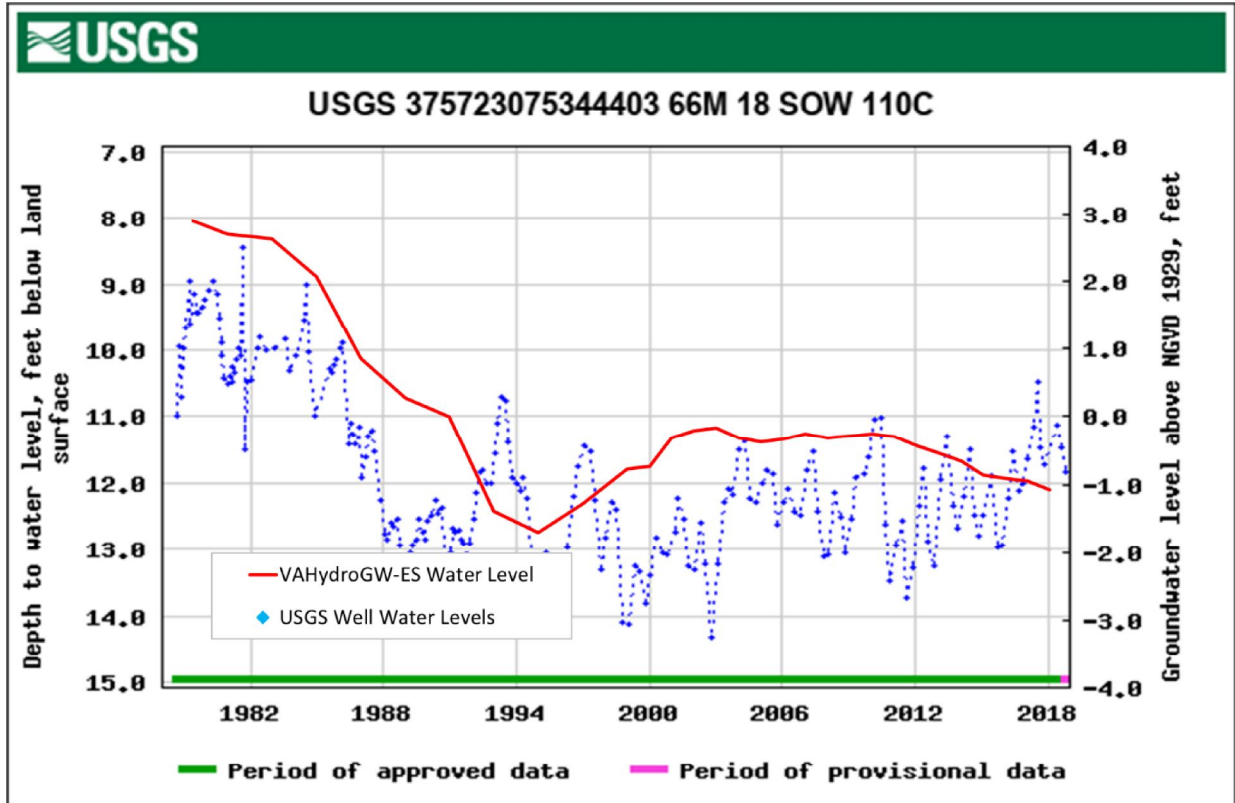


Figure 8. USGS Regional Observation Well 66M 18 SOW 110C, Lower Yorktown-Eastover aquifer water levels recorded from 1978 to present (well depth 240 ft bls, land surface 11 ft msl).

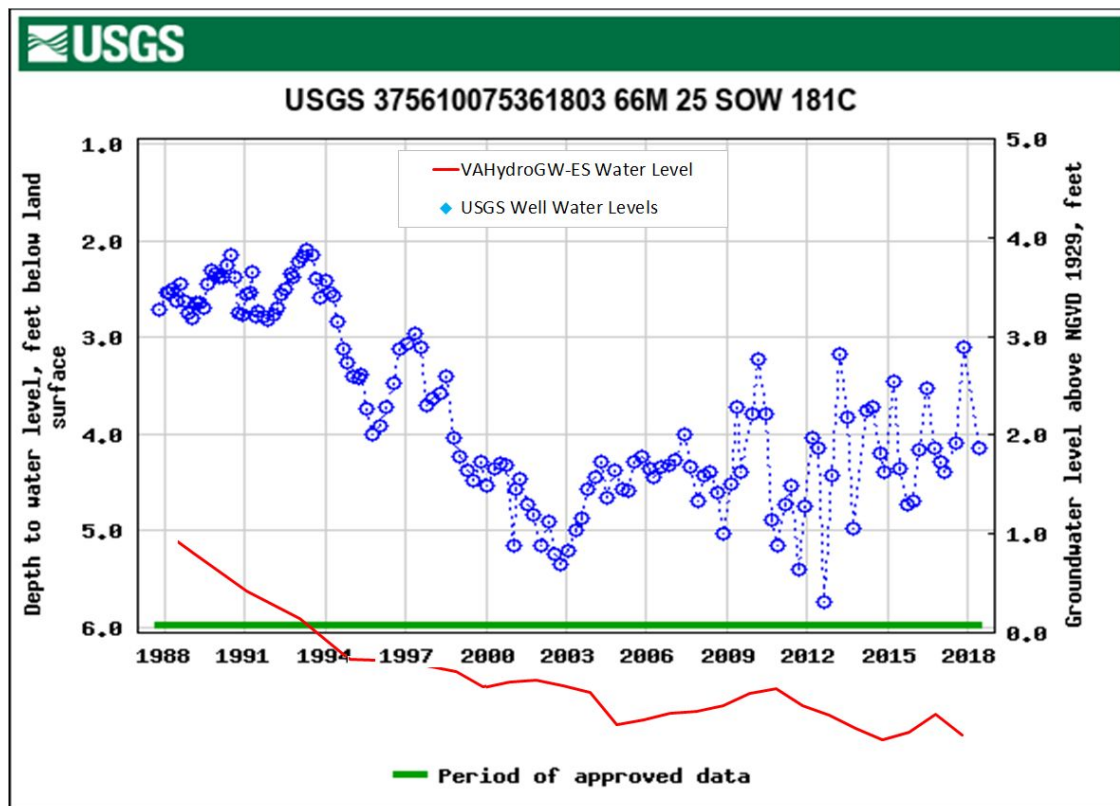


Figure 9. USGS Regional Observation Well 66M 25 SOW 181C, Lower Yorktown-Eastover aquifer water levels recorded from 1987 to present (well depth 340 ft bls, land surface 6 ft msl).

Aquifer Test(s):

An aquifer test has not been conducted for this system and the VAHydroGW-ES model was used to evaluate the application. The following table provides the average hydrogeologic properties assigned to the VAHydroGW-ES cell(s) containing the applicant wells.

Virginia Eastern Shore Model Hydrogeologic Properties: Row 58/Column 57							
Aquifer	Top Elevation (feet msl)	Top Elevation (feet bls)	Aquifer Thickness (feet)	Horizontal Conductivity (feet/day)	Vertical Conductivity (feet/day)	Specific Storage (1/feet)	Specific Yield
Columbia	40	0	71	75	0.5	0.00001	0.15
Upper Yorktown-Eastover	-94	134	45	10	6.4	0.000004	N/A
Middle Yorktown-Eastover	-179	219	31	9	16.3	0.000004	N/A
Lower Yorktown-Eastover	-238	278	103	8	5.1	0.000004	N/A

Model Results

Evaluation of Withdrawal Impacts:

The VAHydroGW-ES model was used to simulate the effects resulting from the proposed withdrawal due to the multi-aquifer impacts. The stabilized effects resulting from the proposed withdrawal were simulated at the annual permitted withdrawal rate of 8,000,000 gallons per year (21,918 average gpd). The stabilized effects were simulated by replacing the reported use amounts in the 2017 VAHydroGW-ES Reported Use Simulation with the current maximum annual withdrawal limit allowed under the terms of their permit for all Ground Water Management Area (GWMA) permit holders. That same simulation

was executed twice, once with the proposed withdrawal removed (the *baseline simulation*), and once with the proposed withdrawal added (the *proposed withdrawal simulation*). The stabilized effects of the proposed withdrawal were considered by simulating both simulations for 50 years and observing the difference in water potentiometric levels at the end of the simulations.

Area of Impact:

The AOI for an aquifer is the area where the additional drawdown due to the proposed withdrawal exceeds one foot. The results of the VAHydroGW-ES simulations, outlined in the preceding section, predict areas of impact in the Middle and Lower Yorktown-Eastover aquifers. The AOI areas extend a maximum distance of approximately 0.4 and 0.3 miles from the production center for the Middle and Lower Yorktown-Eastover aquifers. AOI maps for all affected aquifers are attached to this report.

80 % Drawdown:

The 80% drawdown criterion was evaluated for all impacted, confined aquifers in the Virginia Eastern Shore using the VAHydroGW-ES *proposed withdrawal simulation*. The elevations of the top of the Upper, Middle, and Lower Yorktown-Eastover aquifers at the VAHydroGW-ES cell (row 58, column 57) simulating the greatest drawdown are -94, -179, and -238 feet msl, respectively. Based on the results of the *proposed withdrawal simulation* the predicted potentiometric water levels at the same VAHydroGW-ES cell are -6.8, -12.0, and -11.4 feet msl for the Upper, Middle, and Lower Yorktown-Eastover aquifers, respectively. The 80% drawdown criterion allows the potentiometric water level (based on the critical surface elevation calculated from the VAHydroGW-ES data) to be reduced to -71.5, -139.7, and -187.4 feet msl in the Upper, Middle, and Lower Yorktown-Eastover aquifers, respectively. Therefore, the water levels in the VAHydroGW-ES cell containing the applicant wells for each confined aquifer are not simulated to fall below the critical surface. Additionally, no new VAHydroGW-ES cells are simulated to have water levels fall below the critical surface. Therefore, this withdrawal is within the limits set by the 80% drawdown criterion.

The requested withdrawal is allocated 100% to the Middle Yorktown-Eastover aquifer. The technical evaluation analysis indicated that the apportionment of the requested withdrawal amount among the applicant production wells had no significant effect on the outcome of the technical evaluation.

Water Quality:

The EPA has established the National Secondary Drinking Water Regulations (NSDWRs) which are non-enforceable guidelines regulating contaminants that may cause cosmetic or aesthetic (such as taste, odor, or color) effects in drinking water. The EPA recommends the secondary standards to water systems – states may choose to adopt them as enforceable standards. The EPA NSDWRs specify the limit on chloride as 250 mg/L.

The VAHydroGW-ES was created "to help the Commonwealth and local water managers better plan water use and estimate future changes in water and salinity levels in response to changes in water use."⁴ Use of the model to predict future chloride concentrations results in a "general useful understanding of system behavior, but water-resource managers must be careful in trusting the accuracy of predictions at individual wells from a regional model."⁵ Further, chloride concentrations at individual wells, predicted using the regional model, should not be relied upon to predict actual concentrations at those locations.

⁴ Sanford, W.E., Pope, J.P., and Nelms, D.L., 2009, Simulation of groundwater-level and salinity changes in the Eastern Shore, Virginia: U.S. Geological Survey Scientific Investigations Report 2009–5066, 125 p.

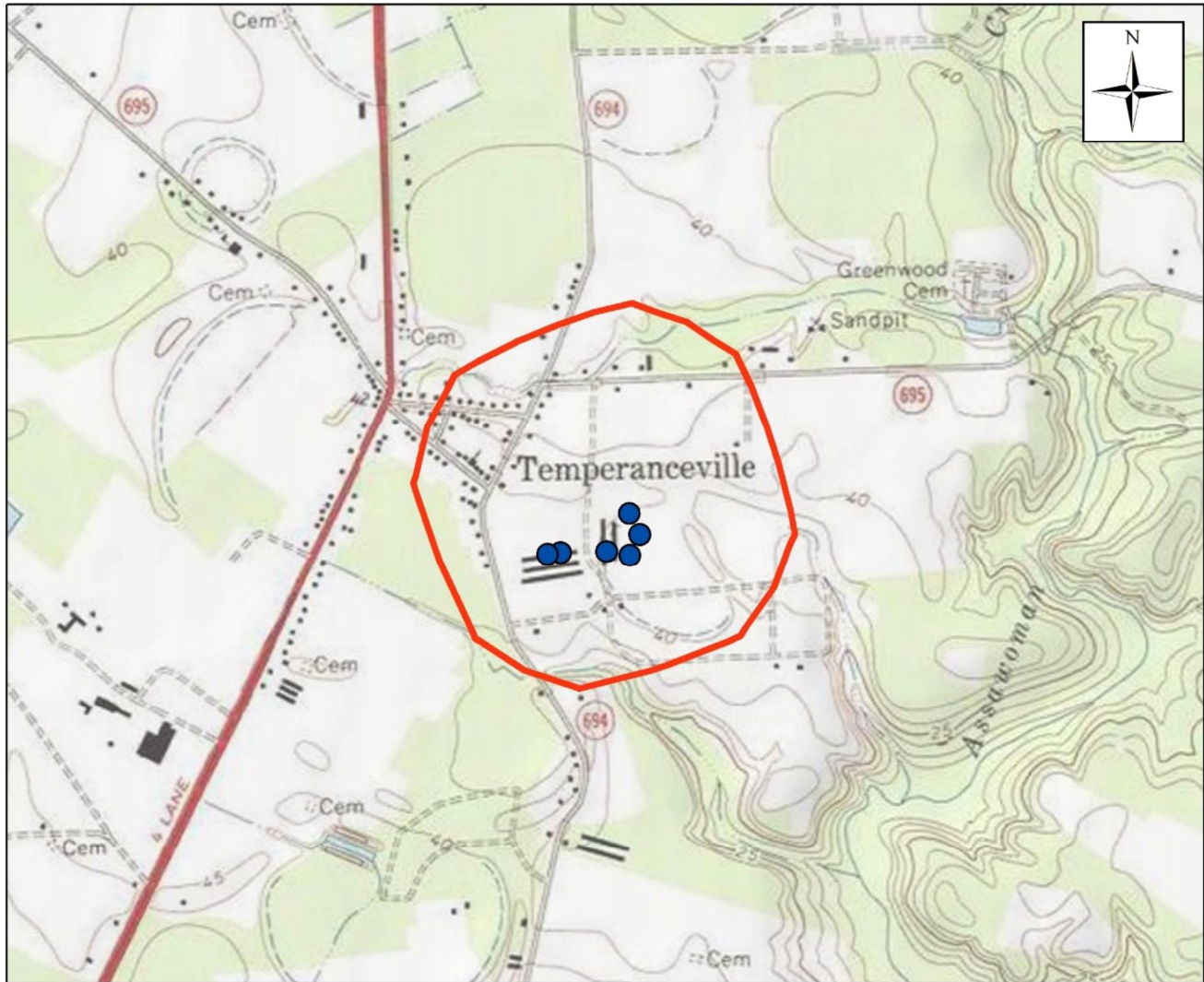
⁵ Sanford, W.E. and Pope, J.P., 2009, Current challenges using models to forecast seawater intrusion: lessons from the Eastern Shore of Virginia, USA. Hydrogeology Journal (2009), Volume: 18, Issue: 1, p: 73-93

The potential for adverse changes to water quality due to the requested withdrawal was evaluated using transient, density-dependent, SEAWAT simulations using the VAHydroGW-ES. Two simulations were executed – one simulation without the proposed withdrawal included and a second with the proposed withdrawal included. Both simulations were executed for 50 years. And both used the 2017 total permitted stresses, concentrations, and heads as starting conditions. In an effort to simulate the long-term effects on water quality due to the proposed withdrawal, the amount of 8,000,000 gallons per year (21,918 average gpd) was used for the duration of the second simulation. The two simulations were compared to evaluate the potential for adverse changes to water quality. The results indicated that no model cells simulate an increase in chloride concentration greater than 20 mg/L due to the proposed withdrawal. Therefore, the VAHydroGW-ES model results do not indicate the potential for reduced water quality as a result of the proposed withdrawal.

Conclusion:

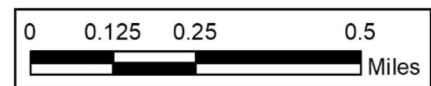
The withdrawal requested by Edward Thornton for the Ed, Pat, and Brandy Sue Farm withdrawal satisfies the technical evaluation criteria for permit issuance. The AOIs for the Middle and Lower Yorktown-Eastover aquifers are shown in the following maps. There are no existing permitted wells located within the applicant's AOI.

Ed, Pat, and Brandy Sue Farm Area of Impact - Middle Yorktown-Eastover Aquifer



● Ed, Pat, and Brandy Sue Farm Wells

○ Middle Yorktown-Eastover Aquifer Area of Impact

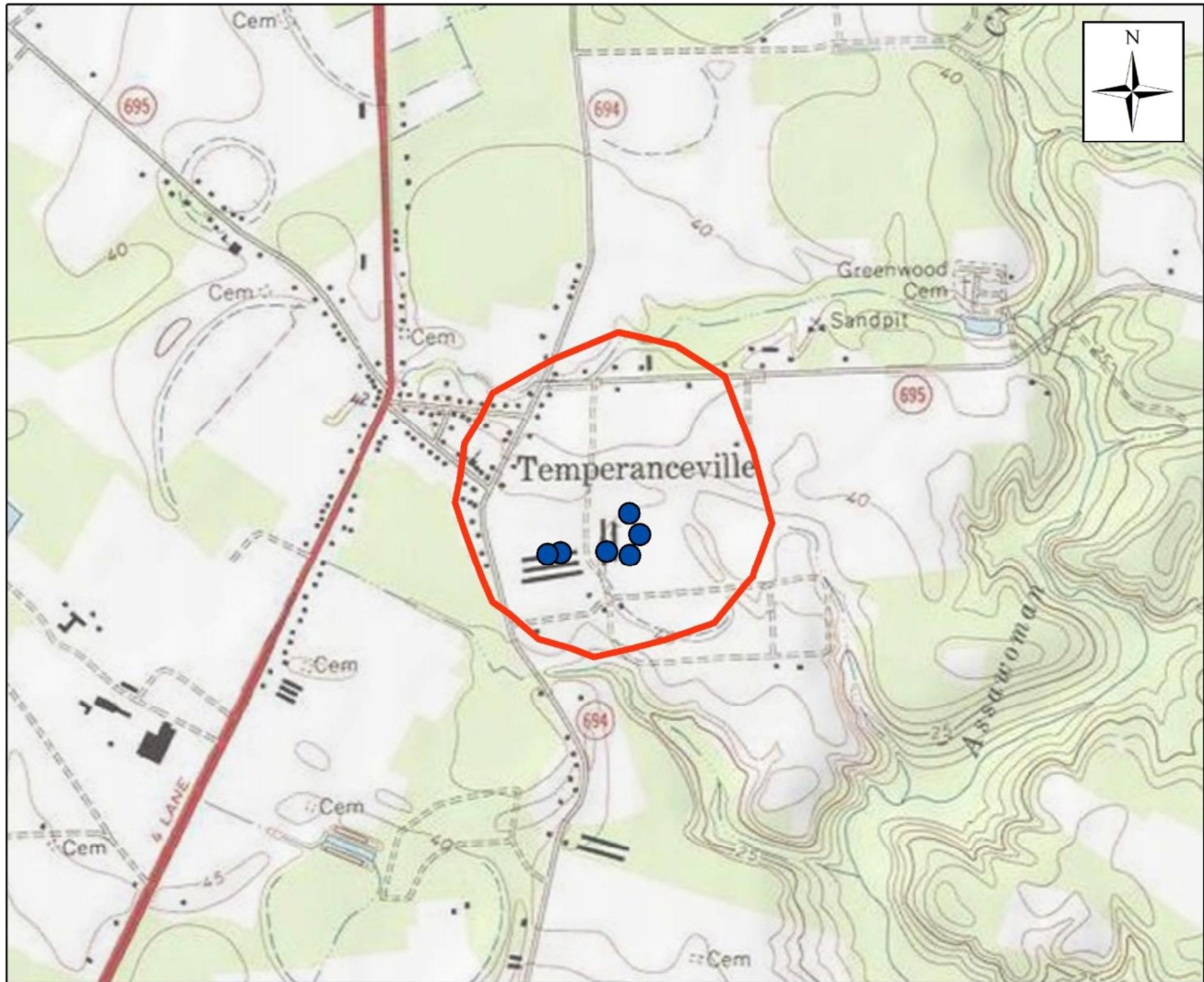


Simulated drawdown at or exceeding one foot in the Middle Yorktown-Eastover aquifer resulting from a 8,000,000 gallon per year (21,918 average gpd), 50 year withdrawal from the Middle Yorktown-Eastover aquifer using the VAHydroGW-ES. Maximum radius of one foot drawdown (Area of Impact) extends approximately 0.4 miles from the pumping center.

Technical evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
December 14, 2018

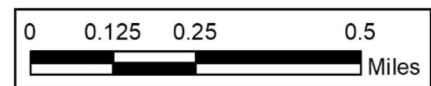


Ed, Pat, and Brandy Sue Farm Area of Impact - Lower Yorktown-Eastover Aquifer



● Ed, Pat, and Brandy Sue Farm Wells

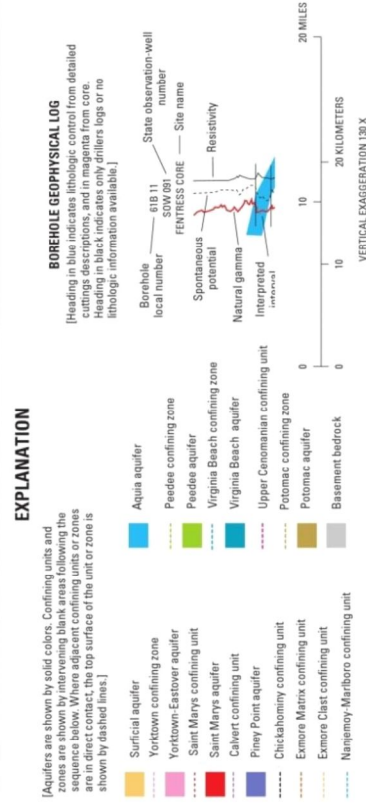
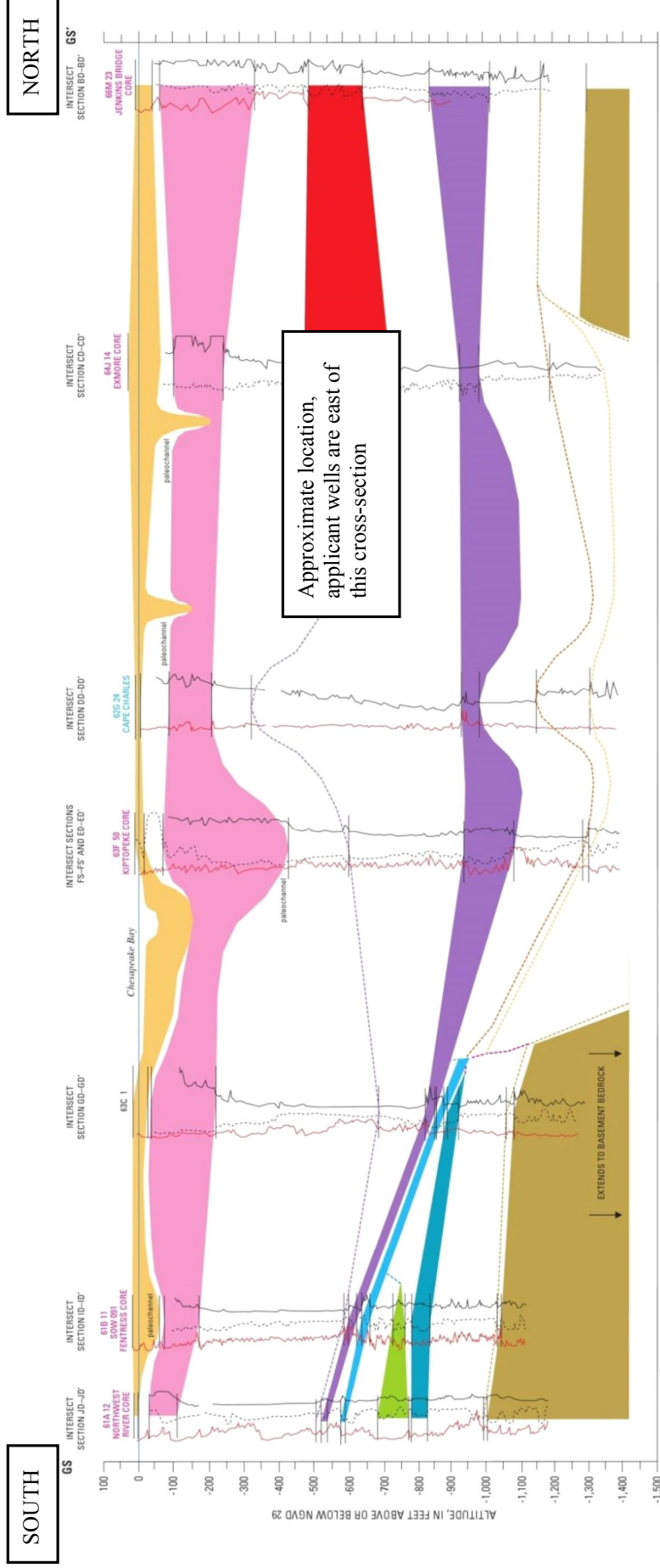
○ Lower Yorktown-Eastover Aquifer Area of Impact



Simulated drawdown at or exceeding one foot in the Lower Yorktown-Eastover aquifer resulting from a 8,000,000 gallon per year (21,918 average gpd), 50 year withdrawal from the Middle Yorktown-Eastover aquifer using the VAHydroGW-ES. Maximum radius of one foot drawdown (Area of Impact) extends approximately 0.3 miles from the pumping center.

Technical evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
December 14, 2018





Coastal Plain (2006) Cross-Sections GS-GS' from USGS Professional Paper 1731.

Section 10. Ground water Conservation and Management Plan

**Edward Thornton
Ed, Pat & Brandysue Farm
Tax Parcel ID: 41-A-161A, 41-2-A
Temperanceville, Accomack Virginia**

March, 2018

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1.0 GENERAL INFORMATION

The Ed, Pat & Brandysue Farm, herein referred to as the “Farm”, is an agricultural farm primarily used to grow chickens. The facility also provides water to a small cattle operation and a single-family home. This farm is located within the town of Temperanceville, Accomack County Virginia.

Typical potable water needs at the Farm require consumption of varying amounts of ground water from its six-well system affected by the time of year, humidity, and the growth stage of the chickens. These wells are located on the Farm property. Because this property is located within the Eastern Shore Ground water Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared in accordance with the Ground Water Management Act of 1992, Chapter 25 (§62.1-254 et seq.) of Title 62.1 of the Code of Virginia. The purpose of this document is to analyze water supply and demand issues facing the Farm and develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide the management of the Farm, who are responsible for the operation and policy management decisions. Lastly, this document will meet the Ground Water Withdrawal Permit requirement for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a plan to implement water conservation measures. This Water Conservation and Management Plan, referred to herein as the “Plan” includes identification of water demand and water source and then provide guidance to implement water management and conservation measures.

2.0 WATER DEMAND

Water demand at this Farm is primarily associated with chicken water consumption. Chickens require a precise amount of water. If an improper amount is provided to the chickens, either too much or too little, their health will be significantly affected. The amount of water needed is monitored on a daily basis through the use of computerized measurements, visual inspections of the houses, and knowledge of the animal's water needs at the different growth stages. A much smaller amount of groundwater is used to operate evaporative cooling units, for cattle consumption, for general cleaning and sanitizing and to provide for a single-family home.

The Farm has the capacity to operate 8 chicken houses requiring groundwater. Potable water is withdrawn directly from the wells. Potable water at this Farm is administered to the chickens through the use of drip nozzles, a low-flow design. The drip emitters are placed along PVC piping that runs the length of the chicken houses. These lines are automatically pressurized by the wells when pressure switches installed in the facility supply lines dictate.

Evaporative cooling pads cool the houses when needed and are automatically activated based on thermostats installed within the houses. These thermostats are set between approximately 62 and 90 degrees Fahrenheit depending on the stage of growth, size of the birds, ambient temperature and humidity. These cooling pads capture and reuse water and, as such, reduce overall groundwater consumption. The total cooling pad area in use at the facility is 1,251' x 5'.

It should also be noted that chickens require a precise amount of water and the chickens themselves determine the amount of water they drink. If the chickens are provided too little water they will begin to die and this reduces the pounds of chicken the farm can produce and is therefore avoided by the operation. Too much water, on the other hand, is also undesirable because any water on the ground in the houses can cause the spread of bacteria, viruses, etc., also potentially reducing the pounds of chicken that can be sold. Due to the use of these practices, there are limited additional opportunities to conserve water.

Water used for cleaning and sanitizing must be measured and used in accordance with cleanser manufacturer's recommended dilution and application rates. Therefore, it is unlikely that more water can be conserved during the cleaning and sanitizing processes.

3.0 WATER SUPPLY

The following section presents a general overview of water resources available to the Farm. The Farm is not tied to any municipal water supply. There are six (6) wells at the Farm that currently supply groundwater of an adequate quality and quantity.

This region receives approximately 42 inches of precipitation per year. The Farm does not reclaim stormwater runoff however; this water would not be useful to the operation because the operation requires potable water.

4.0 WATER CONSERVATION MEASURES AND WATER LOSS REDUCTION PROGRAM

The following conservation measures will be implemented with regard to the water supply including groundwater from the Farm's wells.

- Chicken will be provided water using the drip nozzle method to minimize water waste.
- There will be no unnecessary groundwater withdrawals. Water withdrawn under the Farm's Groundwater Withdrawal Permit is withdrawn to supply the chickens and cattle with drinking water and to clean and sanitize the chicken houses and equipment.
- Farm management will review water use monthly and will implement changes when identified:
 - The Owner's consultant maintains an electronic database to record, monitor, and review the required monthly well meter readings.
- Monthly inspections for surface or subsurface leaks will be conducted for all well heads, evaporative cooling units, meters, main lines, and drip nozzles. Subsurface leaks will be determined where the ground surface is abnormally saturated or where blowouts occur.
- *Water Use Education Program:* Employees will receive instruction as to the importance of efficient water use and conservation methods annually during their orientation.
- *Water Reuse Evaluation:* Chicken require a precise amount of water and the chickens themselves determine the amount of water they drink. Therefore, there is little that can or would be done to reduce water use from this beneficial use. If the chickens are provided too little water they will begin to die and this reduces the pounds of chicken the farm can produce and is therefore avoided by the operation. Too much water, on the other hand, is also undesirable because any water on the ground in the houses can cause the spread of bacteria, viruses, etc., also potentially reducing the pounds of chicken that can be sold. Since no excess water is used there is no opportunity to reuse water. Further, water used for cleaning and sanitizing must be measured and used in accordance with manufacturer's recommended dilution and application rates. Therefore, it is unlikely that more water can be conserved during the cleaning and sanitizing process.
- Any leak discovered in the water supply system will be repaired as soon as is practical or will be bypassed so as to minimize loss of water. The owner is on-site daily as water is used to gauge the proper operation of the water use and delivery systems.

- Mandatory water use restrictions will be implemented during water shortage emergencies declared by the local governing body, the Director of DEQ, or the Governor. Non-essential uses of water will be restricted. In addition, Farm personnel will be prohibited from general washing of buildings, paved surfaces, or non-essential equipment. The Farm will comply with penalties for demonstrated failure to comply with mandatory water use restrictions.

- *Water Conservation:* Water conservation efforts shall be followed in order to preserve the resource and right to withdraw water from the resource.

- The facility has a vested financial interest in saving water. This is because water use at this facility requires electricity to run the well pumps, evaporative cooling units, electric valves etc. Furthermore, water use contributes well pump wear and eventual failure. Because electricity and failing appurtenances cost the facility money, staff is consistently mindful and proactive when it comes to unintentional water use at the facility.

- *Water Loss Reduction Program:* Attached to this plan as Appendix A is the Operational Plan Inspection Report which will be used to fulfill the need for a facility groundwater audit, leak detection and repair program and will act as a scheduling implement for inspections of water using devices and areas. The Operational Plan for the conservation of water at the facility is as follows:
 - 1) Bi-annually the Operational Plan Inspection Report will be filled out by site personnel and this report will include, but not be limited to, the water used during the months assessed compared to crop stages, etc., leak inspection/detection, leak repair schedules, water use area/device inspections and any high volume water consumption by the facility.

 - 2) This plan will act as a scheduling tool and report form for the facility to refer to in order to properly document leaks and have them repaired in a timely fashion. Each inspection report should comment on the previous report's findings and set dates, deadlines and schedules for repairing leaks.

 - 3) A groundwater audit will be conducted annually during the first two years of the permit cycle. Primarily, this will consist of the comparison of the total groundwater withdrawn month to month and year to year when compared with the flock grown, and in comparison to previous years and expectations based on population, etc.

 - 4) Photographs can be included in the report in order to track the progression of a device which may be failing or a repair in progress.

APPENDIX A – WATER LOSS REDUCTION PROGRAM OPERATIONAL PLAN AND SCHEDULE

MITIGATION PLAN

DEQ GROUNDWATER WITHDRAWAL PERMIT NO. GW0072800

OWNER NAME: Edward Thornton

FACILITY NAME: Ed, Pat & Brandysue Farm

LOCATION: Temperanceville, Va

INTRODUCTION

On 12/1/17, Edward Thornton submitted a Groundwater Withdrawal Permit Application to the Virginia Department of Environmental Quality (DEQ) to withdraw groundwater. Groundwater withdrawals associated with this permit will be utilized to operate a poultry growing operation.

The purpose of this Mitigation Plan is to provide existing groundwater users a method to resolve claims that may arise due to the impact of the withdrawal from Ed, Pat & Brandysue Farm well field. Predicted drawdown of water levels due to the withdrawal(s) from the Middle Yorktown Eastover aquifer are shown in the attached maps(s) provided by DEQ.

Modeled impacts, as shown on the attached maps, extend beyond the boundary of the Ed, Pat & Brandysue Farm facility. Due to these findings, Edward Thornton recognizes that there will be a rebuttable presumption that water level declines that cause adverse impacts to existing groundwater users within the area of impact are due to this withdrawal. Claims may be made by groundwater users outside this area; however, there is a rebuttable presumption that Edward Thornton has not caused the adverse impact. Edward Thornton proposes this plan to mitigate impacts to existing users and excludes impacts to wells constructed after the effective date of this permit.

CLAIMANT REQUIREMENTS

To initiate a claim, the claimant must provide written notification of the claim to the following address:

Contact Name	<u>Edward Thornton</u>
Title	<u>Owner</u>
Permittee Name	<u>Edward Thornton</u>
Address	<u>30327 Thornton Ln.</u>
City, State Zip Code	<u>Temperanceville, VA 23442</u>

The claim must include the following information: (a) a deed or other available evidence that the claimant is the owner of the well and the well was constructed and operated prior to the effective date of the permit; (b) all available information related to well construction, water levels, historic yield, water quality, and the exact location of the well sufficient to allow Edward Thornton to locate the well on the claimant's property; (c) the reasons the claimant believes that the Ed. Pat & Brandysue Farm withdrawal has caused an adverse impact on the claimants well(s).

CLAIM RESOLUTION

Edward Thornton will review any claim within **five (5) business days**. If Edward Thornton determines that no rebuttal will be made and accepts the claim as valid, Edward Thornton will so notify the claimant and will implement mitigation within **thirty (30) business days**. If the claim is not accepted as valid, Edward Thornton will notify the claimant that (a) the claim is denied **or** (b) that additional documentation from the claimant is required in order to evaluate the claim. Within **fifteen (15) business days** of receiving additional documentation from the claimant, Edward Thornton will notify the claimant (a) that Edward Thornton agrees to mitigate adverse impacts or (b) the claim is denied. If the claim is denied, the claimant will be notified that the claimant may request the claim be evaluated by a three (3) member committee. This committee will consist of one (1) representative selected by Edward Thornton, one (1) representative selected by the claimant, and one (1) representative mutually agreed upon by the claimant and Edward Thornton.

Any claimant requesting that a claim be evaluated by the committee should provide the name and address of their representative to Edward Thornton. Within **five (5) business days** of receipt of such notification, Edward Thornton will notify the claimant and claimant's representative of the identity of Edward Thornton representative and instruct the representatives to select a third representative within **ten (10) business days**. Representatives should be a professional engineer or hydrogeologist with experience in the field of groundwater hydrology. Edward Thornton agrees to reimburse the members of the committee for reasonable time spent, at a rate prevailing in the area for experts in the above listed fields, and for direct costs incurred in administering the plan. The claimant may, at his or her option, choose to provide the reimbursement for the member of the committee selected by the claimant and up to half of the reimbursement for the mutual representative.

Within **ten (10) business days** of selection of the third representative, the committee will establish a **reasonable deadline** for submission of all documentation it needs to evaluate the claim. Both the claimant and Edward Thornton will abide by this deadline.

Within **fifteen (15) business days** of receipt of documentation, the committee will evaluate the claim and reach a decision by majority vote. The committee will notify the claimant regarding its decision to (a) deny or (b) approve the claim. If the claim is approved, Edward Thornton will mitigate the adverse impacts within **thirty (30) business days** of making the

decision or as soon as practical. If the claim is denied by the committee, Edward Thornton may seek reimbursement from the claimant for the claimant's committee representative and one half of the 3rd representative on the committee.

If a claimant within the indicated area of impact indicates that they are out of water, Edward Thornton will accept the responsibility of providing water for human consumptive needs within **seventy-two (72) hours** and to cover the claim review period. Edward Thornton reserves the right to recover the cost of such emergency supply if the claim is denied by Edward Thornton or found to be fraudulent or frivolous. If Edward Thornton denies a claim and the claimant elects to proceed with the three (3) member committee, Edward Thornton will continue the emergency water supply at the claimants request during the committee's deliberations, but reserves the right to recover the total costs of emergency water supply in the case that the committee upholds the denial of the claim. Similarly, Edward Thornton reserves the right to recover costs associated with the claim process if a claim is found to be fraudulent or frivolous.

If it is determined by the committee or shown to the committee's satisfaction that a well operating under a mitigation plan similar to Edward Thornton's Plan other than those owned and operated by Edward Thornton has contributed to the claimed adverse impact, Edward Thornton's share of the costs associated with mitigation will be allocated in proportion to its share of the impact. Such a determination shall be made by the committee after notification of the third party well owner, giving the third party well owner opportunity to participate in the proceedings of the committee.

PLAN ADMINISTRATION

Nothing in the Plan shall be construed to prevent the Department of Environmental Quality Staff from providing information needed for resolution of claims by the committee.

The claim must include the following information: (a) a deed or other available evidence that the claimant is the owner of the well and the well was constructed and operated prior to the effective date of the permit; (b) all available information related to well construction, water levels, historic yield, water quality, and the exact location of the well sufficient to allow Edward Thornton to locate the well on the claimant's property; (c) the reasons the claimant believes that the Ed. Pat & Brandysue Farm withdrawal has caused an adverse impact on the claimants well(s).

CLAIM RESOLUTION

Edward Thornton will review any claim within **five (5) business days**. If Edward Thornton determines that no rebuttal will be made and accepts the claim as valid, Edward Thornton will so notify the claimant and will implement mitigation within **thirty (30) business days**. If the claim is not accepted as valid, Edward Thornton will notify the claimant that (a) the claim is denied **or** (b) that additional documentation from the claimant is required in order to evaluate the claim. Within **fifteen (15) business days** of receiving additional documentation from the claimant, Edward Thornton will notify the claimant (a) that Edward Thornton agrees to mitigate adverse impacts or (b) the claim is denied. If the claim is denied, the claimant will be notified that the claimant may request the claim be evaluated by a three (3) member committee. This committee will consist of one (1) representative selected by Edward Thornton, one (1) representative selected by the claimant, and one (1) representative mutually agreed upon by the claimant and Edward Thornton.

Any claimant requesting that a claim be evaluated by the committee should provide the name and address of their representative to Edward Thornton. Within **five (5) business days** of receipt of such notification, Edward Thornton will notify the claimant and claimant's representative of the identity of Edward Thornton representative and instruct the representatives to select a third representative within **ten (10) business days**. Representatives should be a professional engineer or hydrogeologist with experience in the field of groundwater hydrology. Edward Thornton agrees to reimburse the members of the committee for reasonable time spent, at a rate prevailing in the area for experts in the above listed fields, and for direct costs incurred in administering the plan. The claimant may, at his or her option, choose to provide the reimbursement for the member of the committee selected by the claimant and up to half of the reimbursement for the mutual representative.

Within **ten (10) business days** of selection of the third representative, the committee will establish a **reasonable deadline** for submission of all documentation it needs to evaluate the claim. Both the claimant and Edward Thornton will abide by this deadline.

Within **fifteen (15) business days** of receipt of documentation, the committee will evaluate the claim and reach a decision by majority vote. The committee will notify the claimant regarding its decision to (a) deny or (b) approve the claim. If the claim is approved, Edward Thornton will mitigate the adverse impacts within **thirty (30) business days** of making the

decision or as soon as practical. If the claim is denied by the committee, Edward Thornton may seek reimbursement from the claimant for the claimant's committee representative and one half of the 3rd representative on the committee.

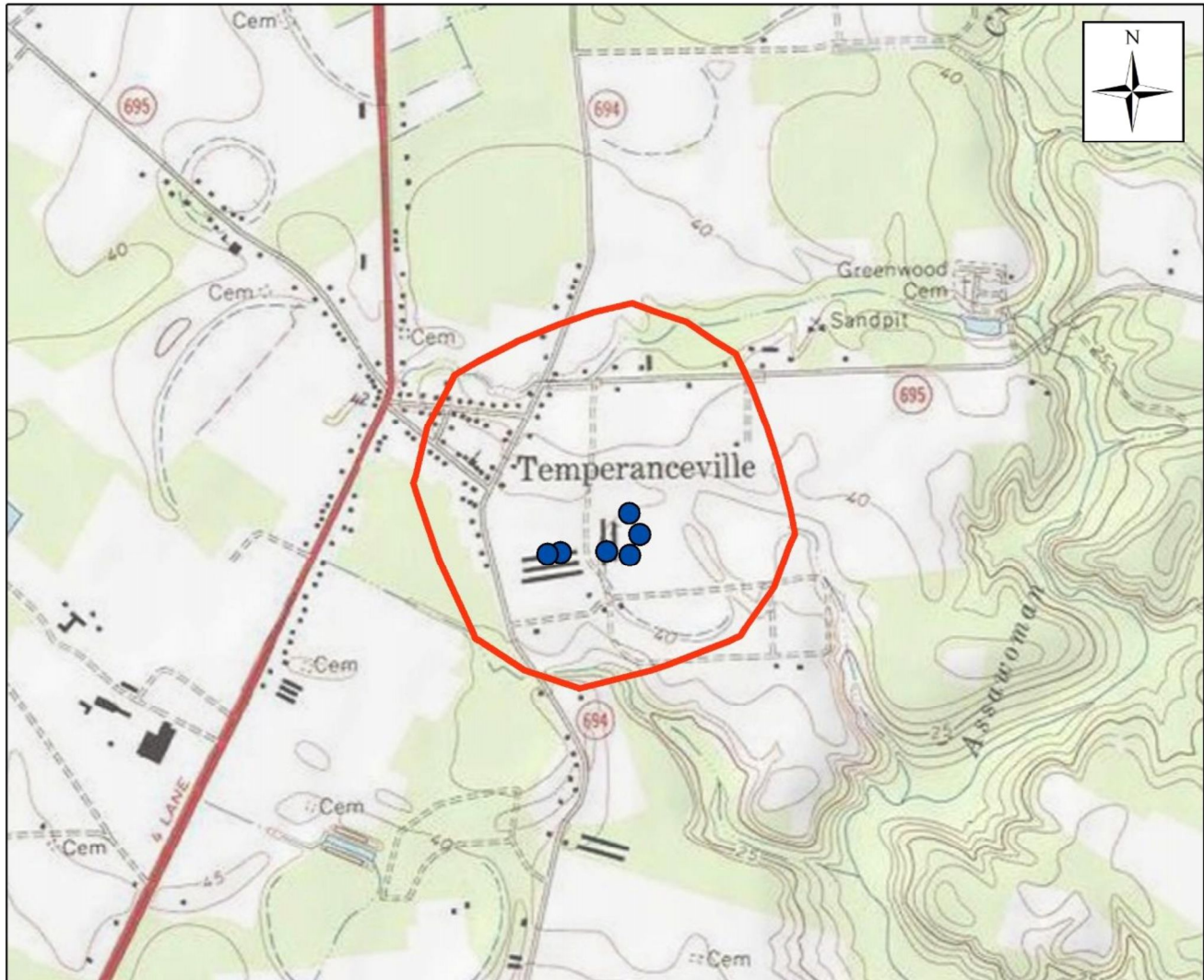
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If it is determined by the committee or shown to the committee's satisfaction that a well operating under a mitigation plan similar to Edward Thornton's Plan other than those owned and operated by Edward Thornton has contributed to the claimed adverse impact, Edward Thornton's share of the costs associated with mitigation will be allocated in proportion to its share of the impact. Such a determination shall be made by the committee after notification of the third party well owner, giving the third party well owner opportunity to participate in the proceedings of the committee.

PLAN ADMINISTRATION

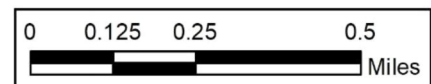
Nothing in the Plan shall be construed to prevent the Department of Environmental Quality Staff from providing information needed for resolution of claims by the committee.

Ed, Pat, and Brandy Sue Farm Area of Impact - Middle Yorktown-Eastover Aquifer



● Ed, Pat, and Brandy Sue Farm Wells

○ Middle Yorktown-Eastover Aquifer Area of Impact

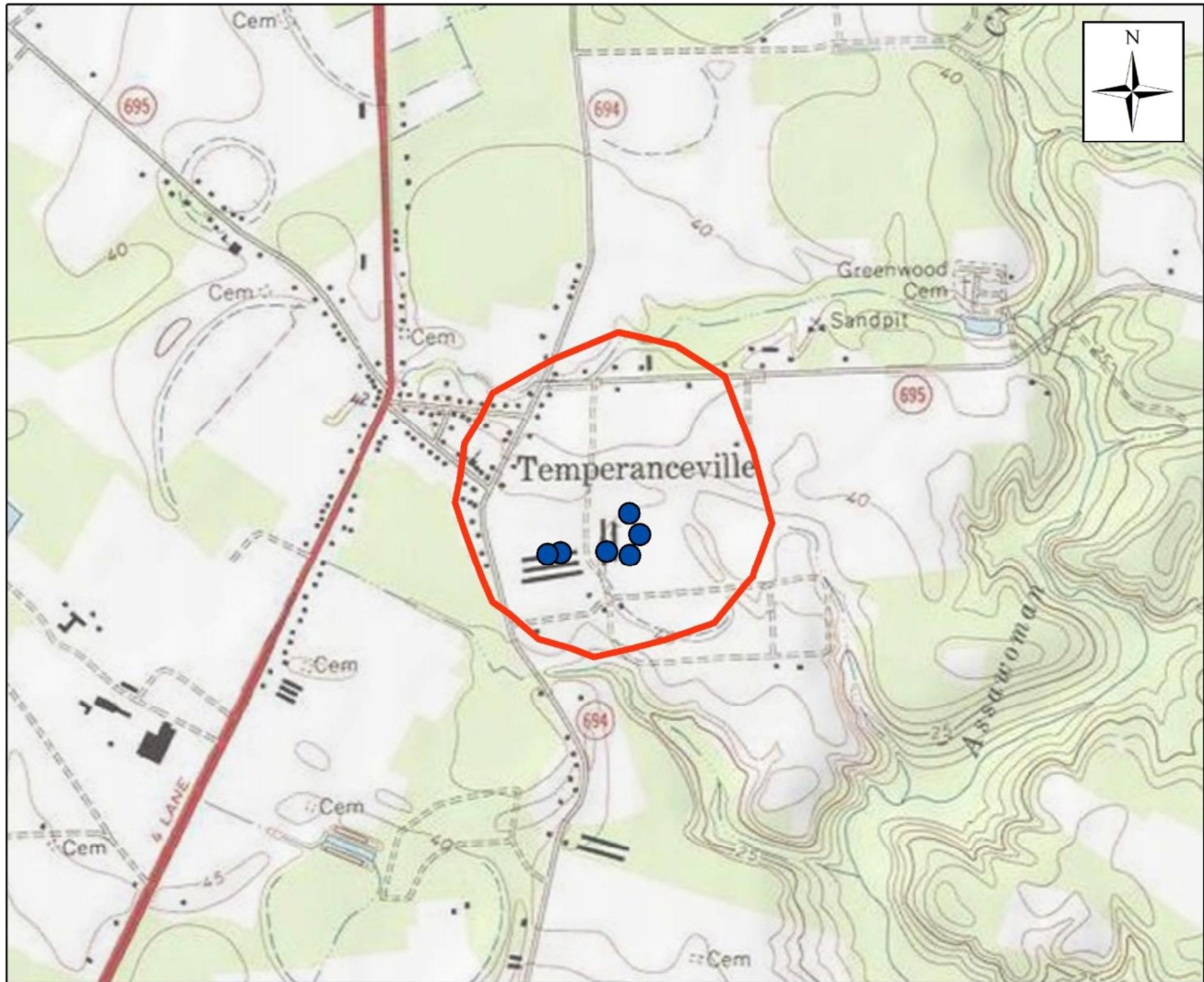


Simulated drawdown at or exceeding one foot in the Middle Yorktown-Eastover aquifer resulting from a 8,000,000 gallon per year (21,918 average gpd), 50 year withdrawal from the Middle Yorktown-Eastover aquifer using the VAHydroGW-ES. Maximum radius of one foot drawdown (Area of Impact) extends approximately 0.4 miles from the pumping center.

Technical evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
December 14, 2018

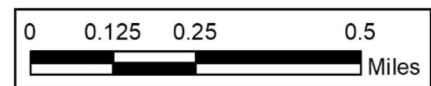


Ed, Pat, and Brandy Sue Farm Area of Impact - Lower Yorktown-Eastover Aquifer



● Ed, Pat, and Brandy Sue Farm Wells

○ Lower Yorktown-Eastover Aquifer Area of Impact



Simulated drawdown at or exceeding one foot in the Lower Yorktown-Eastover aquifer resulting from a 8,000,000 gallon per year (21,918 average gpd), 50 year withdrawal from the Middle Yorktown-Eastover aquifer using the VAHydroGW-ES. Maximum radius of one foot drawdown (Area of Impact) extends approximately 0.3 miles from the pumping center.

Technical evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
December 14, 2018



the other hand, is also undesirable because any water on the ground in the houses can cause the spread of bacteria, viruses, etc., also potentially reducing the pounds of chicken that can be sold. The owner/operator is on-site daily as water is used to gauge the proper operation of the water use and delivery systems.

Documentation of Beneficial Use

The beneficial use of water on-site is the growth of hundreds of thousands of chickens for human consumption per year. Sparse water use data is currently available as meter readings for all wells began in August 2017. Unfortunately, backflow was discovered to be an issue at one of the wells and this produced inaccurate (negative) meter readings for the months of August and September 2017. This backflow issue has since been repaired. Electronic monitoring of each chicken house's water consumption for a single flock has been provided in Table 1 as a starting point for analysis of water use at the Ed, Pat and Brandysue Farm.

Water Demand Projections

The data in Tables 1, 2, 2A, 3, and 4 are utilized in order to determine the monthly and annual groundwater requirements for the Farm. The owner intends to utilize all of the available 8 houses to grow chickens.

The total annual withdrawal requirement is calculated through several steps. Table 1 sums the water use from an actual flock that required 50 days to grow for a total of 564,237 gallons. Table 2 multiplies the gallons/flock/house summed in table 1 with the flocks/year and the typical mortality rate. This product is summed with the estimated gallons required annually for evaporative cooling and this sum is divided by the square footage of each house for the Gallons/ Square Foot of House/ Year figure. Finally, the greatest of these figures (46.74 Gal/ft²/yr for House #4) is then multiplied by the total grow area in Table 3 (167,000 ft²) for an annual maximum withdrawal requirement of 7,805,580 gallons.

Total Annual Withdrawal =

$$\left(\left(\frac{\text{Gallons}}{\text{Flock}} * \frac{\text{Flocks}}{\text{House}} * \frac{\text{Flocks}}{\text{year}} * \text{Mortality Rate} \right) + \text{Evap.} \right) / \text{House Area} * \text{Total Ft}^2 \text{ of Facility Houses}$$

The mortality rate is included in the above calculation because despite the fact that typically 2% of the birds die within a given flock, it is possible that all of them survive and will require water. The annual cooling water requirement/ house is calculated through a methodology provided by DEQ (shown in Table 2A) and is detailed on the attachments provided at the end of Section 8. The tunnel fan capacity (in ft³/minute or CFM) for all houses is multiplied by 1.6 gallons/CMF to determine an annual withdrawal estimate of 2,688,000 gallons/year.

The total monthly withdrawal requirement is calculated through several steps and is shown in Table 4. Since a flock takes approximately 50 days to mature and water consumption increases as the flock grows, the maximum rate of water use during a month will occur when the birds spend their last 31 days at the facility and those 31 days occur within the same month. Therefore, the summation of days 20-50 total water use in Table 1 (481,225 gallons) is multiplied by the mortality rate (1.02) and this figure summed with the evaporative cooling water

requirement (1,344,000 gallons) for a monthly maximum withdrawal requirement if 1,834,849 gallons. The total annual evaporative cooling water use value of 2,688,000 gallons calculated in Table 2A is divided by 2 months before inclusion in Table 4 to allow for operational flexibility.

The cattle operation and single-family home on the property also utilize the chicken house well system. The single-family home (two occupants) is estimated to required 50 GPD x 2 Persons x 365 Days for a total of 36,500 gallons per year and 50 GPD x 2 Persons x 31 Days for a total of 3,100 gallons per month.

The cattle operation consists of 38 head of Black Angus beef cattle and this number varies depending on the sale and birth of calves. The cattle require water daily and drink from a trough. The cattle are estimated to require an average of 12 gallons of drinking water per day and 20 gallons per day during hot weather based on VA Tech Cooperative Extension data provided by DEQ. The annual cattle groundwater requirement is calculated as follows:

38 cattle x 12 GPD x 274 Days (9 cool Months) for a total of 124,994 Gallons during cool weather.

38 cattle x 20 GPD x 91 days (3 hot months) for a total of 69,160 gallons for an

Annual cattle consumption total = 124,994+69,160 = 194,154 gallons.

The monthly cattle groundwater requirement is calculated as follows: 38 cattle x 20 GPD x 31 Days for a total of 23,560 gallons per month. These values have been added to the annual and monthly withdrawal amounts calculated for the chicken houses above and have been placed in section 5 on page 1 of this application.

As is clear from the well meter reading data collected thus far (shown in Table 5), some amount of water is currently unaccounted for within this evaluation and the withdrawal amounts requested represent a first draft estimation of the water requirements on-site. These requests may need to be revised before permit issuance as water use/allocation troubleshooting is on-going.

Apportionment of Withdrawal

Table 5 shows the limited amount of apportionment data available. The data is limited because meter readings began in August 2017 and have been read on a monthly basis following the installation. Well apportionment percentages change on a seasonal and intermittent basis.

Unfortunately, backflow was discovered to be an issue at one of the wells and this produced inaccurate (negative) meter readings for the months of August and September 2017. This backflow issue has since been repaired but backflow likely still impacted the positive withdrawal amounts observed in October 2017.

Table 1 - Flock Water Consumption (gallons)

Day	House #1 Water Use (Gal)	House #2 Water Use (Gal)	House #3 Water Use (Gal)	House #4 Water Use (Gal)	House #5 Water Use (Gal)	House #6 Water Use (Gal)	House #7 Water Use (Gal)	House #8 Water Use (Gal)	Total
1	6	37	84	57	77	73	3	0	337
2	72	90	167	113	173	118	61	11	805
3	135	160	244	187	252	216	94	36	1,324
4	138	178	278	229	291	274	140	62	1,590
5	161	206	313	263	332	308	215	94	1,892
6	222	270	377	342	404	358	255	137	2,365
7	272	323	427	410	443	488	322	191	2,856
8	354	402	561	539	545	665	425	252	3,743
9	383	436	569	553	574	722	648	569	4,454
10	412	466	621	579	619	593	582	402	4,274
11	439	522	650	647	696	715	675	500	4,844
12	481	576	708	732	710	823	760	609	5,399
13	522	615	780	782	842	897	855	718	6,011
14	516	584	765	764	826	860	806	677	5,798
15	639	732	821	882	894	976	895	806	6,645
16	652	739	900	988	957	1041	937	869	7,063
17	695	790	1023	1020	982	1061	1007	814	7,392
18	741	848	1067	1008	1018	1154	1127	1026	7,989
19	798	899	1101	952	1095	1216	1086	1084	8,231
20	835	954	1148	1323	1169	1332	1334	1177	9,272
21	863	965	1209	1312	1187	1432	1364	1253	9,585
22	908	1034	1328	1340	1259	1529	1439	1341	10,178
23	955	1139	1424	1396	1390	1632	1524	1393	10,853
24	975	1154	1480	1430	1475	1717	1600	1443	11,274
25	1023	1180	1527	1458	1548	1791	1709	1545	11,781
26	1094	1245	1602	1572	1572	1885	1829	1636	12,458
27	1147	1334	1695	1648	1661	1843	1927	1722	12,977
28	1159	1358	1691	1654	1675	1740	1922	1725	12,924
29	1197	1442	1733	1653	1775	2079	1984	1670	13,533
30	1246	1473	1812	1679	1719	2146	1981	1727	13,783
31	1208	1397	1723	1654	1717	2072	1899	1667	13,337
32	1390	1534	1831	1769	1845	2146	1911	1762	14,188
33	1436	1532	1905	1835	1878	2072	2130	1857	14,645
34	1435	1552	1865	1907	1930	2081	2121	1922	14,813
35	1411	1504	1759	1829	1880	2262	2153	1920	14,718
36	1406	1571	1882	1817	1918	2338	2208	1979	15,119
37	1622	1654	2077	2008	1982	2200	2219	2167	15,929
38	1646	1700	2150	2070	2079	2301	2212	2051	16,209
39	1661	1784	2199	2130	2086	2413	2498	2085	16,856
40	1773	1824	2270	2240	2172	2643	2508	2270	17,700
41	1872	1924	2340	2290	2189	2639	2437	2340	18,031
42	1818	2046	1940	2360	2230	2675	2464	2239	17,772
43	1905	2079	2350	2410	2284	2593	2541	2370	18,532
44	2010	2321	2480	2480	2321	2689	2590	2387	19,092
45	2143	2197	2570	2513	2378	2689	2642	2461	19,593
46	2246	2240	2590	2543	2410	2764	2687	2497	19,977
47	2379	2346	2620	2594	2467	2798	2741	2532	20,477
48	2854	2470	2680	2670	2497	2860	2796	2576	21,403
49	2940	2580	2800	2689	2540	2893	2860	2624	21,926
50	2950	2670	2801	2700	2589	2940	2940	2700	22,290
Total	57,145	60,909	72,937	72,000	71,575	81,713	78,063	69,895	564,237

Table 2 - Annual House Water Use

	Gallons/Flock	Annual Gallons for Evap. Cooling	Flocks/Year	House Area (ft ²)	Mortality Rate	Gal/ ft ² of House/ Year
House #1	57,145	307,200	6	20,000	1.02	32.85
House #2	60,909	307,200	6	20,000	1.02	34.00
House #3	72,937	307,200	6	20,000	1.02	37.68
House #4	72,000	307,200	6	16,000	1.02	46.74
House #5	71,575	307,200	6	16,000	1.02	46.58
House #6	81,713	384,000	6	25,000	1.02	35.36
House #7	78,063	384,000	6	25,000	1.02	34.47
House #8	69,895	384,000	6	25,000	1.02	32.47

Table 2A: Annual Cooling Pad Water Use

	Air Speed (FPM)	House Width (ft)	House Height (ft)	Tunnel Fan Capacity (CFM) = FPM x W x H	Annual Cooling Water Use (Gal) = CFM x 1.6 Gal/Yr/CFM
House #1	600	40	8	192,000	307,200
House #2	600	40	8	192,000	307,200
House #3	600	40	8	192,000	307,200
House #4	600	40	8	192,000	307,200
House #5	600	40	8	192,000	307,200
House #6	600	50	8	240,000	384,000
House #7	600	50	8	240,000	384,000
House #8	600	50	8	240,000	384,000
Total	4,800	350	64	1,680,000	<u>2,688,000</u>

Table 3 - Total Annual Withdrawal Requirement

Total House Area (ft²)	Total Max Withdrawal (Gal/ft²/Year)	Annual Maximum Amount Required (Gal)
167,000	46.74	7,805,580

36,500 human consumption

194,150 cattle consumption

8,036,230 total

(above calculation added for clarity by permit writer, details are in narrative, above)

Table 4 - Total Monthly Withdrawal Requirement

Last 31 Days of Flock Consumpton (Gal)	Mortality Rate	Evap. Cooling Water (Gal)	Monthly Maximum Amount Required (Gal)
481,225	1.02	1,344,000	1,834,850

3,100 human consumption
 + 23,560 cattle consumption

 1,861,510 total monthly

(above calculation added for clarity by permit writer, details are in narrative, above)